WELSH BIRDS

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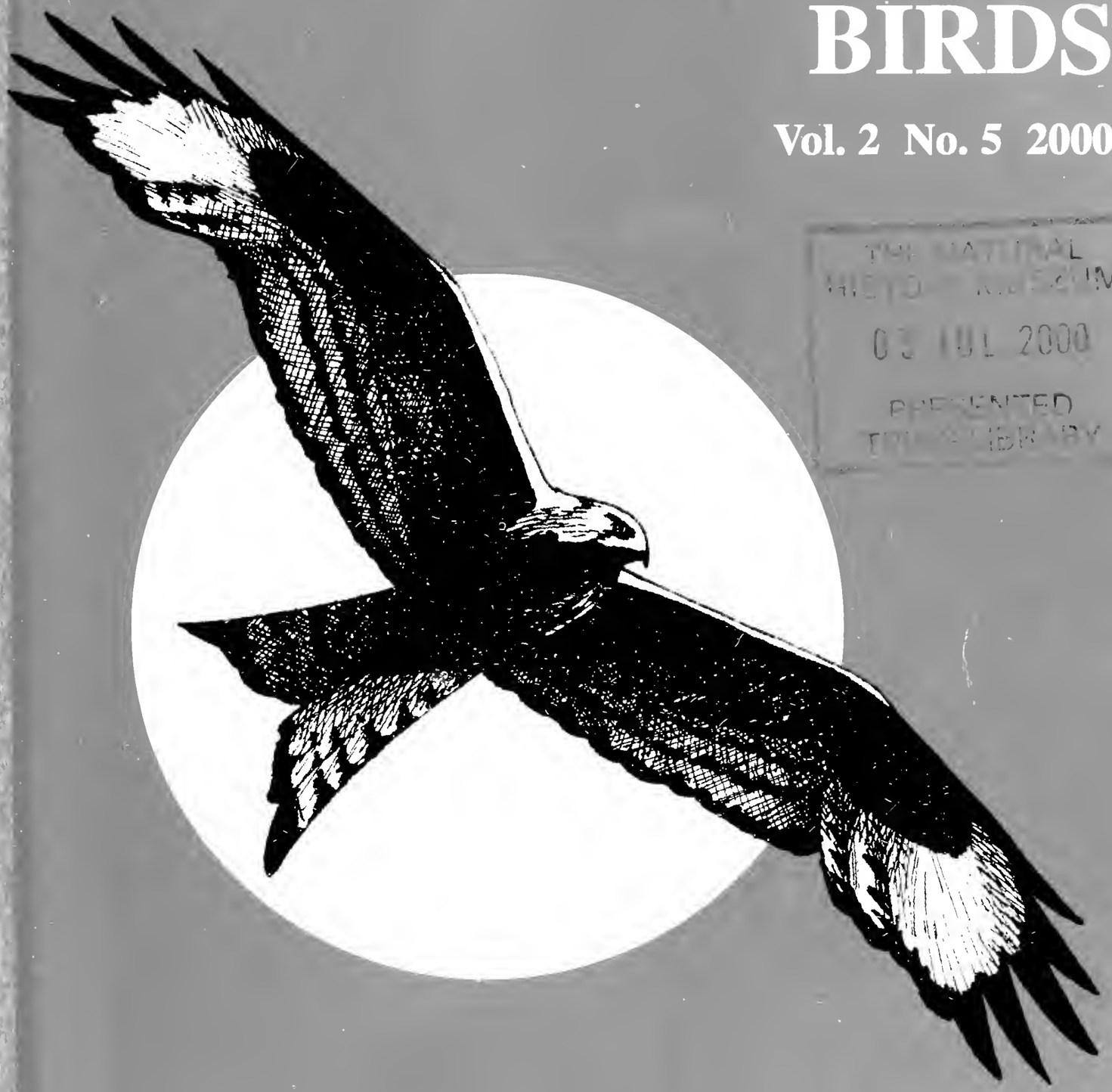

Cymdeithas Adaryddol Cymru

Welsh Ornithological Society

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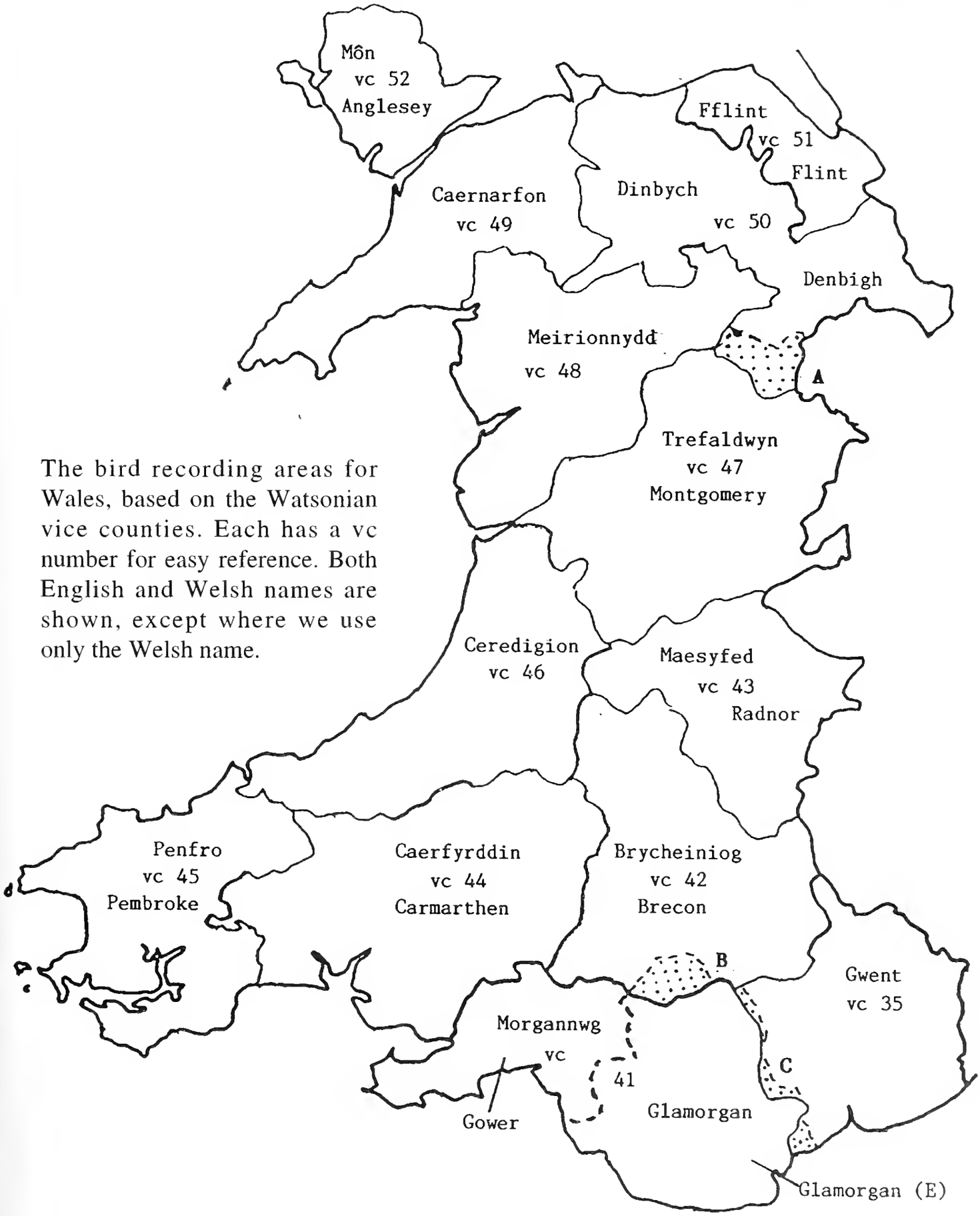
EDITORIAL

The map opposite shows the present arrangement of bird recording areas in Wales, which are used in Welsh Birds. Following the creation of Unitary Authorities as the basis of local Government, the Welsh Ornithological Society decided to switch to the Watsonian Vice-county system (see the Ray Society, publication No. 146) as the basis of bird recording in Wales. These are virtually synonymous with the pre-1974 administrative Counties used by the Society until 1996. Using the Watsonian vice-county system therefore retains historical continuity in recording. This would have been lost in any attempt to follow the Unitary Authorities, the only one of which involves no changes from the county system created in 1974, let alone its historic predecessor, being Powys, which comprises the vice-counties of Breconshire, Radnorshire and Montgomeryshire. Note, however, that the name of Gwent has been retained for the vice-county of Monmouth to prevent confusion with the new Unitary Authority of Monmouth, which covers only part of the vice-county. Full details of recording areas and arrangements in Wales are published annually in the Welsh Bird Report.

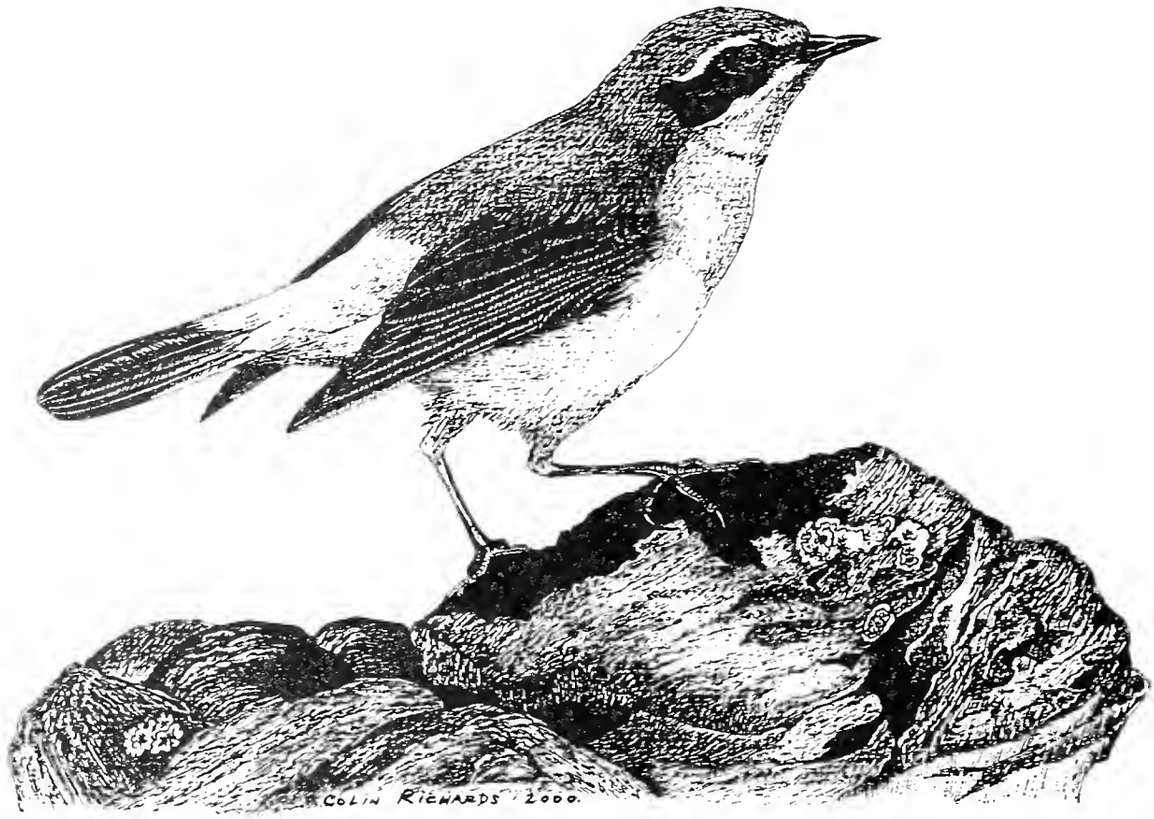
ACKNOWLEDGEMENTS

Once again it is a pleasure to acknowledge the help of a number of people in putting this issue together. As always we are grateful to Bob Mitchell, Steve Roberts and Colin Richards for illustrations for the journal. This unfailing support is of great assistance. The Editor also acknowledges the very considerable help of all those who have acted as Referees for papers, namely Reg Thorpe, Graham Williams, Iolo Williams and Martin Peers. It is an important task, which should not go unnoticed. The Editor must also thank Tony Prater for his help in preparing figures for the printer.

The Bird Recording Areas in Wales



The bird recording areas for Wales, based on the Watsonian vice counties. Each has a vc number for easy reference. Both English and Welsh names are shown, except where we use only the Welsh name.



A REPORT ON BIRD RINGING IN WALES DURING 1998

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INTRODUCTION

This is the eleventh annual report on bird ringing in Wales and, if last year was bad enough, the adult total for this year plumbs a new low, again by a considerable margin. This seems to be due in part to changes in effort by several of the more active ringers, possibly a lack of birds during a mild winter and by Bardsey Bird Observatory having its worst ever season for ringing - despite there being two keen ringers on the island. The *pulli* total is still on the low side, with some significant reductions in numbers of woodland species ringed.

METHOD OF ENQUIRY AND RESPONSE

As is usual this report is based on the information sent back to me by ringers who responded to my letter sent out in early 1999. They were asked to supply ringing totals for the year, indicate any major changes in effort and let me know the details of any interesting ringing recoveries received during the year. I know that the start of the year involves much form filling and my thanks go to all those who take the trouble to reply. For 1998 replies were received from 34 ringers and 8 groups.

THE RINGING TOTALS

Given that this year's full grown total is just about half that of the previous 10 years (with the exception of 1997) it is not surprising that there were no new highs achieved but plenty of new lows. Some of the lowest totals are for summer migrants and reflect the truly appalling season on Bardsey, with notable examples being: Willow Warbler, 293 (normally c.1,500-2,000); Robin, 41 (120-170); Blackbird, 7 (100-200); Redwing, 6 (200-400); Sedge Warbler, 71 (300-600); Whitethroat, 26 (usually over 100); Blackcap, 29 (100-150) and Chaffinch, 54 (250-550) (Table 1). These show the effects clear weather or winds from the wrong direction at the wrong time can have on the routes taken by migrants.

Table 1. Systematic List of Birds Ringed in Wales during 1997 and 1998

	1997		1998			1997		1998	
Species	*FG*	*Pull*	*FG*	*Pull*	*Species*	*FG*	*Pull*	*FG*	*Pull*
Little Grebe	1	–	–	–	Kittiwake	40	193	22	125
Fulmar	4	–	8	–	Common Tern	–	384	–	590
Manx Shearwater	434	207	859	158	Little Tern	–	27	–	–
Storm Petrel	98	–	122	–	Guillemot	–	42	3	401
Leach's Petrel	3	–	1	–	Razorbill	126	179	79	208
Cormorant	3	309	–	266	Puffin	23	63	21	54
Shag	1	264	2	307	Stock Dove	–	20	1	16
Grey Heron	1	8	–	–	Woodpigeon	6	4	9	6
Mute Swan	112	55	58	130	Collared Dove	3	8	3	–
Canada Goose	240	–	253	–	Cuckoo	–	1	–	1
Shelduck			1	14	Barn Owl	8	84	13	89
Mallard	6	6	4	–	Little Owl	2	–	2	6
Teal	–	–	1	–	Tawny Owl	8	19	8	31
Goosander	–	12	–	–	Long-eared Owl	1	–	5	5
Red Kite	–	118	–	146	Nightjar	1	4	1	3
Hen Harrier	–	23	–	36	Swift	13	–	5	3
Sparrowhawk	7	43	7	17	Kingfisher	13	–	15	–
Goshawk	–	160	–	200	Hoopoe	1	–	–	–
Buzzard	–	48	1	50	Green Woodpecker	1	–	–	–
Kestrel	3	45	–	39	Gt. Sp. Woodpecker	11	2	13	–
Merlin	–	12	–	24	Less. Sp. Woodpecker	1	–	–	–
Hobby	–	8	–	8	Skylark	3	1	–	4
Peregrine	–	40	1	28	Sand Martin	507	5	122	–
Water Rail	8	–	–	–	Swallow	1060	292	411	255
Coot	1	8	1	–	House Martin	15	–	76	2
Moorhen	14	–	29	2	Rock Pipit	2	–	–	–
Oystercatcher	705	6	280	2	Tree Pipit	16	9	2	7
Little Ringed Plover	25	8	–	20	Meadow Pipit	46	15	22	55
Ringed Plover	26	4	28	–	Yellow Wagtail	–	–	9	–
Grey Plover	–	–	1	–	Grey Wagtail	12	94	14	39
Lapwing	5	54	4	47	Pied Wagtail	37	54	14	67
Knot	214	–	35	–	Dipper	68	270	41	152
Little Stint	–	–	4	–	Wren	328	44	396	26
Dunlin	1203	–	590	–	Dunnock	252	6	238	33
Curlew Sandpiper	–	–	2	–	Robin	428	125	470	45
Ruff	1	–	–	–	Nightingale	2	–	–	–
Jack Snipe	2	–	5	–	Black Redstart	4	–	1	–
Snipe	–	–	10	–	Redstart	45	338	28	141
Curlew	164	–	93	–	Whinchat	6	264	27	747
Black-tailed Godwit	–	–	1	–	Stonechat	16	21	12	170
Redshank	252	–	332	1	Wheatear	29	138	11	60
Common Sandpiper	3	9	–	–	Ring Ouzel	1	6	–	–
Turnstone	30	–	–	–	Blackbird	507	113	318	55
Black-headed Gull	6	220	1	68	Fieldfare	3	–	–	–
Less. B-backed Gull	37	964	18	954	Song Thrush	120	54	127	33
Herring Gull	3	116	17	562	Redwing	243	–	26	–
Gt. Black-backed Gull	–	63	–	150	Mistle Thrush	7	18	3	14

	1997		1998			1997		1998	
Species	*FG*	*Pull*	*FG*	*Pull*	*Species*	*FG*	*Pull*	*FG*	*Pull*
Cetti's Warbler	19	–	15	–	Blue Tit	2760	2168	1757	1404
Grasshopper W.	22	–	13	–	Great Tit	832	1170	829	620
Aquatic Warbler	4	–	–	–	Nuthatch	42	114	40	42
Lanceolated Warbler	1	–	–	–	Treecreeper	44	11	27	–
Sedge Warbler	1057	5	728	–	Golden Oriole	1	–	–	–
Reed Warbler	1059	9	1061	8	Woodchat Shrike	–	–	1	–
Booted Warbler	–	–	1	–	Jay	5	–	4	–
Icterine Warbler	1	–	–	–	Magpie	12	61	10	22
Melodious Warbler	1	–	1	–	Chough	8	238	3	257
Subalpine Warbler	2	–	–	–	Jackdaw	30	10	17	16
Barred Warbler	1	–	–	–	Carrion Crow	–	31	1	26
Lesser Whitethroat	18	–	14	–	Rook	1	25	1	47
Whitethroat	113	3	108	–	Raven	2	113	–	155
Garden Warbler	134	8	135	4	Starling	174	24	75	7
Blackcap	376	16	438	5	House Sparrow	100	–	126	–
Greenish Warbler	1	–	–	–	Tree Sparrow	1	–	–	–
Pallas's Warbler	3	–	–	–	Chaffinch	786	33	507	11
Yellow-browed Warbler	1	–	1	–	Brambling	62	–	19	–
Wood Warbler	18	46	4	26	Greenfinch	800	9	883	10
Chiffchaff	648	21	676	6	Goldfinch	51	10	68	9
Willow Warbler	1552	64	1242	74	Siskin	98	–	333	–
Goldcrest	1161	4	1022	–	Linnet	25	3	14	28
Firecrest	4	–	1	–	Twite	–	–	1	–
Spotted Flycatcher	63	26	44	35	Redpoll	90	–	87	–
Pied Flycatcher	799	6661	544	5185	Bullfinch	109	4	74	5
Long-tailed Tit	220	5	240	–	Common Crossbill	1	–	–	–
Marsh Tit	28	19	16	8	Yellowhammer	23	8	27	9
Willow Tit	21	–	21	–	Reed Bunting	168	–	174	10
Coal Tit	220	71	177	34	**TOTAL**	**21399**	**16697**	**16917**	**14735**

Many of the woodland species showed low totals as well and this may well reflect the generally mild winters we have had over the last few years. Finches and thrushes tend not to form such large flocks and most birds visit gardens less regularly when there is plenty of natural food available in the wild. One exception to this was Siskin which at 333 is the fourth highest total over the last 11 years but their numbers and nomadic wanderings tend to be governed by cone production on fir trees such as the Larch (*Larix*) rather than the current weather.

The *pulli* total, while low at 14,267, is only 13% down on the average for the last 10 years. The main loss is through low totals for Pied Flycatcher, Blue Tit and Great Tit, all 30-50% down on previous years. While this may reflect a real drop in numbers it may also be a reflection on the wet summers we have had recently, ringers generally cannot get around nestboxes if the weather is poor. Three totals stand out as worthy of mention: Red Kite, 146; Goshawk, 200 and Whinchat, 747. These are all new record totals, the first two reflect the still growing populations of the two species, while the Whinchat total is due to another study starting up in the south Breconshire hills. Even though the total seems large the study sites only cover a couple of hillsides which indicates that the total population in south and mid-Wales must be rather large.

RINGING PROJECTS

There was no information on any new ringing projects for the 1998 season and it seems that many projects are still on-going. I will make my usual plea for ringers to look at what they are doing and see if there is any way that the information gathered in their projects can be put out to a wider audience.

Details of some of the work carried out in the 1998 season for one of the Whinchat projects was sent in by Steve Smith, who has been studying the birds of the Gwent hills for some years now. The table below shows the breeding success for birds nesting at 3 sites:

Table 2. Breeding success of the Whinchat at 3 sites in Gwent.

Site	*Pairs present*	*Nests recorded*	*Eggs laid*	*Average c/s*	*Young hatched (%)*	*Young fledged (%)*	*% nests successful*
Blorenge Mountain	35	28	163	5.8	151 (93)	135 (89)	83
Mynydd Garn-Clochdy	29	36	192	5.3	163 (85)	134 (82)	70
Mynydd-y-Garn-fawr	21	21	111	5.2	104 (94)	83 (80)	75
Totals	**85**	**85**	**466**	**5.4**	**418 (90)**	**352 (84)**	**75**

The observed success rate is lower than that quoted in BWP from other work in Britain but still means a large number of young birds fledging each season. In addition 8 adults ringed in previous seasons were retrapped in 1998, indicating that a reasonable percentage of birds are site faithful.

PUBLICATIONS INVOLVING RINGING IN WALES

Once again there is rather a lack of publications:

Howlett, P.M. (1998). A report on bird ringing in Wales during 1997. *Welsh Birds Vol. 2 No. 2* (1998) 70-82. Welsh Ornithological Society.

Anning, D. & Stansfield, S. (1997). Ringing Report 1998. *Bardsey Observatory Report No. 42: 1998. 32-39.*

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Cramp, S. and Perrins, C.M. (eds) *The Birds of the Western Palearctic.*

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SELECTED RINGING RECOVERIES

As is customary in this report the usual plea goes out for non-ringers to let me know of any recoveries they find (obviously informing the BTO first!). It is very difficult to find out about interesting recoveries found by the general public and the BTO's own ringing report is still running a few months behind schedule.

The recoveries are arranged by species, with ringing details on the first line and recovery

details on the second. The symbols and conventions used are outlined below; age is given according to the Euring code, the figures DO NOT represent years.

Age when ringed

1 pullus (= nestling or chick)
2 fully grown, year of hatching unknown
3 hatched during calendar year of ringing
4 hatched before calendar year of ringing but exact year unknown
5 hatched during previous calendar year
6 hatched before previous calendar year but exact year unknown
7 definitely hatched 2 years before year of ringing
8 hatched more than 2 calendar years before year of ringing

Sex

M = male, F = female

Manner of recovery

X found dead
XF found freshly dead or dying
XL found dead (not recent)
+ shot or intentionally killed by man
+F shot or intentionally killed by man-fresh
I found sick or injured-not released
SR found sick or injured-released with ring
V alive and probably healthy, caught and released not by a ringer
VV as V but sighting in field (includes colour mark records)
R caught and released by ringer
B as R - breeding
RR as VV but by a ringer
BB as RR - nesting

Storm Petrel

2295277	4	02.07.94	Strumble Head, Pembrokeshire.
	R	28.06.98	Calf of Man, Isle of Man.
	R	26.07.98	Wooltack Point, Marloes, Pembrokeshire. 36km SW 1485 days.
2424522	4	02.08.97	Mynydd Gilan, Abersoch, Caernarfonshire.
	R	27.07.98	Eilean nan Ron, Highland Region, Scotland. 641km N 359 days.
2443588	4	20.07.96	Strumble Head, Pembrokeshire.
	R	15.08.97	Bardsey, Caernarfonshire. 82km NNE 391 days.
2443641	4	16.07.98	Cilan Head, Abersoch, Caernarfonshire.
	R	19.07.98	Sheepland Harbour, Co. Down. 180km NNW 3 days.

The first and last birds give an indication of how mobile these birds are around the west of Britain, while 2443588 shows that they can, on occasion, take the same route in successive years.

Manx Shearwater

FC91434	2	03.09.97	Bardsey Island, Caernarfonshire.
	I	08.09.97	Chirk, Denbighshire. 296km ENE 5 days.

This poor individual was probably disorientated during bad weather to have ended up so far inland. One bird retrapped on Bardsey had been ringed in 1964, as an adult, making it more than 34 years old. This is not a record but very impressive nonetheless as are another two retraps, one from 1965 and one from 1966.

Cormorant

5197701	1	20.06.98	Puffin Island, Anglesey.
	X	31.10.98	Pontevedra, SPAIN. 41°52'N 8°48'W. 1321km S 133 days.
5197721	1	20.06.98	Puffin Island, Anglesey.
	X	07.11.98	Moy, Dungannon, Tyrone, Northern Ireland. 215km NW 140 days.
5197748	1	20.06.98	Puffin Island, Anglesey.
	X	15.11.98	Xago, Asturias, SPAIN. 43°36'N 5°55'W. 1088km S 148 days.

5197855	1	20.06.98	Puffin Island, Anglesey.
	X	27.08.98	River Gilpin, Lyth Valley, Cumbria. 133km NE 68 days.
5197875	1	20.06.98	Puffin Island, Anglesey.
	X	25.10.98	Ferrol, Coruña, SPAIN. 43°30'N 8°17'W. 1134km S 127 days.
L04075	1	01.07.84	Puffin Island, Anglesey.
	XF	25.10.98	Thorpe Green, Surrey. 318km SE 5229 days.
L05214	1	22.06.86	Puffin Island, Anglesey.
	I	07.03.98	Cercedilla, Madrid, SPAIN. 40°44'N 4°4'W 1398km S 4276 days.

This is only a small selection of the recoveries of the 21 Puffin Island Cormorants received last year. Most British adults do not move far from their breeding areas so it was hard to see what L05214, an 11 year-old bird, would be doing so far inland near Madrid. The other movements are more typical, first year dispersal to the north coast of Spain being quite normal and the majority of the other recoveries were from various parts of the British Isles.

Shag

1349077	1	20.06.98	Puffin Island, Anglesey.
	X	31.10.98	Widmouth Bay, Cornwall. 284km S 133 days.

There were 11 recoveries of 1998 ringed Shag *pulli*, of these this one had travelled the furthest. Most, as is normal for this species, had not even left Gwynedd.

Mute Swan

U4283	3F	12.12.93	Rhyl Marine Lake, Clwyd.
	VV	01.11.97	Corbet Lough, Co. Down. 210km NW 1420 days.

This was the most distant recovery reported during 1998 and is notable for having crossed the Irish Sea, something that Mute Swans seem reluctant to do. There were also a large number of colour-ring sightings but these were restricted to the usual 80-100km, east-west movements of birds between north Wales and the Cheshire/Shropshire area.

Red Kite

GF89782	1	16.06.97	nr. Lampeter, Ceredigion.
	X	22.02.98	Fontmell Down, Shaftsbury, Dorset. 185km SE 251 days.
GF89785	1	18.06.97	nr. Llandysul, Ceredigion.
	X	07.04.98	Tal-y-bont, nr. Barmouth, Meirionnydd. 83km N 293 days.

Despite the number of chicks ringed in the last few years not many have been recovered so far. These 2 give some indication that our kites may be starting to wander more widely as the population increases.

Sparrowhawk

DS57664	1M	06.07.97	nr. Abergavenny, Gwent.
	V	01.08.98	Axminster, Devon. 123km SSW 391 days.

A typical display of juvenile dispersal.

Oystercatcher

456926	1	13.06.94	Alftanes, Kjosar, ICELAND. 64°6'N 22°2'W.
	R	05.10.97	Llanfairfechan, Caernarfonshire. 1587km SE 1220 days.
5091027	1	18.06.94	Trongisvagur, Suderoy, FAEROES. 61°34'N 6°50'W.
	R	19.09.98	Llanfairfechan, Caernarfonshire. 939km S 1554 days.
5108912	1	28.06.98	Voll, Klepp, Rogaland, NORWAY. 58°48'N 5°37'E.
	R	19.09.98	Llanfairfechan, Caernarfonshire. 857km SW 83 days.
FA06523	8	13.02.83	Morfa Conwy, Caernarfonshire.
	X	15.09.96	Vester Vedsted, Jylland, DENMARK. 55°16'N 8°38'E. 840km E 4963 days.

FA59354	8	13.02.94	Llanfairfechan, Caernarfonshire.
	R	29.03.96	River Spey, Newtonmore, Highland.
	R	19.03.97	River Spey, Newtonmore, Highland.
	R	23.03.98	River Spey, Newtonmore, Highland. 424km N
FA66787	8	23.10.94	Wig, Caernarfonshire.
	X	01.06.98	Eyjafjoll, Rangarfjardar, ICELAND. 63°32'N 19°33'W. 1453km NW 1317 days.
FA72240	5	23.03.96	Wig, Caernarfonshire.
	X	04.11.98	Hvalba, FAEROES. 61°36'N 6°57'W. 945km N 956 days.
FA85699	5	22.02.97	Ogwen Estuary, Caernarfonshire.
	+F	29.07.98	Mont St. Michel, Manche, FRANCE. 48°38'N 1°30'W. 541km SSE 522 days.
FS82427	8	19.12.76	Penmon, Anglesey.
	XF	01.09.98	Llanfairfechan, Caernarfonshire. 9km SE 7926 days.

A fine collection of recoveries and controls and still only a small proportion of the 32 received by SCAN ringing group. Catching birds that were ringed as chicks always provides the most information and it is good to see several here giving concrete evidence as to where the birds seen in Wales in the winter come from. FS82427 reached a very good age, although still some way off the record for this species. As well as this one, two 17, two 15, two 14 and four 13 year-old birds were reported showing just how old the average age for this species must be. FA59354 shows good site fidelity at a given time of year; in March it would probably be on its way back to its more northern breeding grounds.

Ringed Plover

NV72236	4	07.09.94	Ynyslas, nr. Borth, Ceredigion.
	X	04.09.97	Baie de Seine, Seine Maritime, FRANCE. 49°28'N 0°23'E. 459km SE 1093 days.

Many of the Ringed Plover wintering in Wales come from the Baltic region, this recovery indicates that they are not always faithful to their wintering site.

Dunlin

3418650	5	24.07.93	Ottenby, Oland, SWEDEN. 56°12'N 16°24'E.
	R	26.01.97	Bangor Harbour, Caernarfonshire. 1357km W 1282 days.
BP54706	3	23.09.98	Newport Sands, Newport, Pembrokeshire.
	R	20.11.98	Poole Harbour, Dorset. 249km SE 58 days.
JN21244	5	15.07.90	Kosakowo, Gdansk, POLAND. 54°38'N 18°31'E.
	R	26.01.97	Bangor Harbour, Caernarfonshire. 1489km WNW 2387 days.
NT09149	5	26.01.97	Bangor Harbour, Caernarfonshire.
	R	02.08.97	Ujscie Redy, Gdansk, POLAND. 54°39'N 16°24'E. 1488km ESE 188 days.
NT09287	6	26.01.97	Bangor Harbour, Caernarfonshire.
	R	07.08.98	Ottenby, Oland, SWEDEN. 56°12'N 16°24'E. 1357km E 558 days.

As with the previous species and as these records show most of the Dunlin seen in Wales over the winter come from some way east and pass through the Baltic on their way here.

Curlew

CT030101	1	08.06.80	Tornio, Lappi, FINLAND. 65°52'N 24°19'E.
	R	19.10.98	Wig, Caernarfonshire. 1206km SW 6707 days.

Still going strong at 18, this bird will have flown a considerable number of kilometres in its life.

Turnstone

News came in of a bird ringed on the Burry Inlet in December 1989, the same bird was trapped in October 4 years later in Burry Port Harbour. Nothing particularly unusual in that except that the bird

was now carrying a second ring, put on in North America. It turns out that the bird had been trapped in July 1993 on Ellesmere Island, Canada at 82°30'N (it would be breeding in this area) and fitted with a radio transmitter. This means it must have flown the 6860km between the far north and west Wales on at least 5 occasions since its initial ringing and as Turnstones are quite long-lived birds it is quite likely to have flown it many times before and, hopefully, since.

Lesser Black-backed Gull

GF13929	1	05.06.94	Flatholm, Glamorgan.
	X	27.09.98	Donana, SPAIN. 37°0'N 6°30'W. 1618km S 1575 days.
GF42044	1	05.07.94	Llyn Trawsfynydd, Meirionnydd.
	VV	01.12.97	Gloucester Tip, Gloucester. 162km SE 1245 days.
GF42069	1	05.07.94	Llyn Trawsfynydd, Meirionnydd.
	VV	30.03.95	Matozinhos, Douro Litoral, PORTUGAL 41°11'N 8°42'W.
	VV	27.10.95	Matozinhos, Douro Litoral, PORTUGAL 41°11'N 8°42'W.
		23.01.97	nr. Hempstead, Gloucester. 165km SE 933 days.
GF42084	1	05.07.94	Llyn Trawsfynydd, Meirionnydd.
	VV	07.10.97	Figueira da Foz, Beira Litoral, PORTUGAL 40°9'N 8°51'W.
	VV	29.11.97	Villanueva de la Serena, Badajoz, SPAIN 38°58'N 5°48'W.
	VV	19.12.97	Figueira da Foz, Beira Litoral, PORTUGAL 40°9'N 8°51'W. 1465km S 1263 days.
GF42107	1	13.07.94	Llyn Trawsfynydd, Meirionnydd.
	VV	30.08.95	Gloucester Tip, Gloucester.
	VV	10.10.95	Calne Landfill, Wiltshire.
	VV	02.12.97	Pinto, Madrid, SPAIN 40°15'N 3°42'W. 1406km S 1238 days
GF42176	1	30.06.96	Llyn Trawsfynydd, Meirionnydd.
	VV	20.10.97	Throckmorton Tip, Hereford & Worcester. 155km SE 477 days.
GF42177	1	30.06.96	Llyn Trawsfynydd, Meirionnydd.
	VV	18.10.97	Lisbon, Estremadura, PORTUGAL 38°40'N 9°12'W. 1632km S 475 days.
GF91092	1	04.07.97	Llyn Trawsfynydd, Meirionnydd.
	VV	06.10.97	Aveiro, Beira Litoral, PORTUGAL 40°40'N 8°40'W. 1405km S 94 days.
GH35117	1	16.07.85	Flatholm, Glamorgan.
	X	04.10.98	Safi, MOROCCO. 32°18'N 9°20'W. 2180km SSW 4828 days
GK80207	3	23.07.79	Bardsey, Caernarfonshire.
	+	27.05.98	Tarnbrook, Lancashire. 201km NE 6883 days.

Note how birds differ in their wintering strategies, even when they are hatched in the same year and probably only a few feet apart. GF42044 and 069 chose to spend their 3rd winter in Britain while 084 chose to go back to southern Europe. By the middle of October GF42176 had only got as far as Hereford and Worcester while 177 had made it to northern Portugal. Madrid is more than 350km from the sea, seemingly an odd place for a gull to spend the winter.

Common Tern

?	1	21.07.74	Shotton, Clwyd.
	R	10.08.98	Teesmouth, Cleveland. 198km NE 8786 days.
?	1	16.06.96	Shotton, Clwyd.
	V	18.02.97	Cape Coast, GHANA. 4732km S 247 days.
?	1	07.07.96	Shotton, Clwyd.
	XF	23.09.96	WESTERN SAHARA. 2923km S 78 days.
L10130	1	24.06.98	Overijssel, NETHERLANDS.
	X	24.09.98	Gwent. 637km E 92 days.

The ring from this bird was found near a Peregrine plucking post in the north of the county, quite what a

Dutch bred bird was doing here in September is a bit of a mystery.

Swallow

?	3	28.07.97	Banwen, Glamorgan.
	R	08.05.98	Barcaggio, CORSICA. 43°0'N 9°24'E. c.1400km SE 284 days

Whinchat

J906933	3	09.08.97	Millbrook, Southampton, Hampshire.
	R	15.06.98	Trefil, Gwent. 159km NW 310 days.

This bird would almost certainly have been fledged from this area in 1997, if the loyalty to their natal area shown by the 8 adults trapped in consecutive years using the same site is anything to go by.

Stonechat

K622661	1	01.07.97	Cwm Claisfer, Breconshire.
	V	04.11.97	Tigzirt, Alger, ALGERIA. 36°54'N 4°7'E. 1759km SE 126 days.

A good number of British Stonechats have been recovered in Algeria, however, not many are fortunate enough to be trapped and then released.

Reed Warbler

J904806	3	19.08.95	Teifi Marshes, Cardigan, Ceredigion.
	R	15.09.95	Villeton, Lot et Garonne, FRANCE. 44°21'N 0°16'E.
	R	18.08.98	Teifi Marshes, Cardigan, Ceredigion. 933km SE 27 & 1095 days

Even though you know the bird has travelled all the way to Africa and back between handlings it is always that bit more special if it has been trapped elsewhere in-between times.

Willow Warbler

5M2583	3	15.08.98	Loch Eye, Highland.
	R	03.09.98	Flat Holm, Glamorgan. 713km SSW 19 days.

Pied Flycatcher

?	5M	26.03.95	Jews Gate, GIBRALTAR.
	R	20.05.97	Llanarmon-yr-Ial, Clwyd. 1891km N 786 days.

It is always good to get ringing recoveries which show that birds actually use the migration routes that we think they do.

Blue Tit

J076711	3F	19.12.93	Pentyrch, Glamorgan.
	R	25.01.98	Clydach, Gwent. 33km NE 1498 days.

A good age for this species, any small song-bird that reaches 5 or 6 years is doing very well.

Starling

P011390	1	27.05.94	Vieksniai, Akmene, LITHUANIA. 56°14'N 22°31'E.
	X	09.07.95	nr. Machynlleth, Montgomery. 1753km W 408 days.
RR60707	5F	02.02.96	Waunfawr, Caernarfonshire.
	XF	01.05.96	Varsseveld, Gelderland, NETHERLANDS. 51°56'N 6°29'E. 735km ESE 89 days.

As many of the recoveries in this report have shown, a Baltic origin for our winter Starlings is not unusual. It is a rather unfortunate fate to fly 1700km only to be eaten by a Peregrine. The bird would have been killed earlier than the finding date suggests, more likely in late March or April.

Chaffinch

J073033	3M	29.11.92	Gilestone, Talybont on Usk, Breconshire.
	X	28.01.98	Talybont on Usk, Breconshire. 2km S 1886 days.

As with the Blue Tit, a respectable age.

Greenfinch

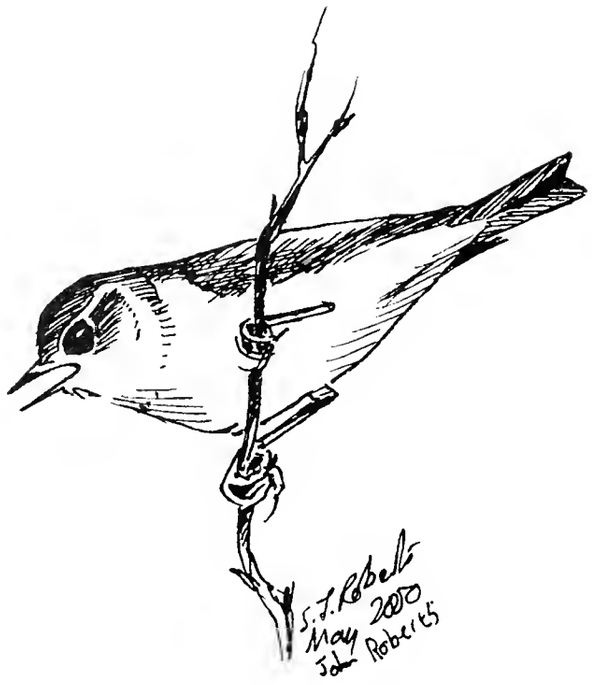
VN84834	4F	05.11.96	Bardsey, Caernarfonshire.
	R	28.12.97	Le Chene, Guernsey. 400km SE 418 days.

This is probably a bird from the Low Countries that has taken a different route in 2 consecutive winters.

Siskin

M028875	5M	14.03.98	nr. Abergavenny, Gwent.
	XF	29.09.98	Port Talbot, Glamorgan. 46km WSW 199 days.

This was probably a local breeder moving south for the autumn/winter.



BREEDING BIRDS AND THE RESTORATION OF A GRASSLAND FARM

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SUMMARY

There is little evidence of the effect of restoration of farmed grassland habitats on common breeding bird numbers. Since 1985, breeding bird numbers have been monitored on a 16.2 ha holding in Ceredigion whilst habitat restoration and a change from intensive to organic management has been implemented. The restoration strategy has been directed towards maximising habitat and species diversity with no priority given to breeding birds. Monitoring of breeding birds on this holding and on adjoining intensive rye-grass farmland has been based on estimates derived from the mapping of breeding territories. After 14 years of restoration, the number of breeding bird species has more than tripled and, per ha, is 4 times that of surrounding intensively farmed land. The number of breeding pairs per ha is now 10 times that of the surrounding land. The results show that this type of restoration can be highly effective in increasing the numbers of birds breeding and highlight the impoverishment of intensively managed grassland.

INTRODUCTION

The national decline of many common bird species is well documented (e.g. Marchant *et al.,* 1990) and often lamented, but it is less clear what can be done to reverse this trend without passively waiting for sweeping changes in agricultural policy and economics. At the national level, recent changes in policy promoting the improvement of farmed habitats in the countryside as a whole are clearly a positive step, but these initiatives tend to be fragmented and their effectiveness is uncertain. Even if the will and resources are available, much more needs to be known about how effective different management strategies can be in restoring farmed habitats to provide breeding and feeding habitat for declining common bird species.

There are two broad strategies available to land managers wishing to improve conditions locally:

a) To optimise conditions for particular species, groups or habitat by directed, interventionist management

b) To try to increase overall biodiversity by intervening as little as possible and allowing a multiplicity of interacting ecosystems to develop.

The difference is only one of emphasis and scale, but most conventional reserve management tends, often for pressing reasons, to concentrate more on the former. This approach is neither feasible nor appropriate for most agricultural land. It has led to the situation where landowners can receive conflicting advice from different countryside agencies with differing priorities. It can also lead to impossible decisions being required as to whether one species or group is more important than another, and it can lead to piecemeal management.

The alternative is to manage land in a way which concentrates on the development of a variety of interacting habitats with no specific intent to benefit any one group of animals or plants. The effects of such less directed management of depleted habitats associated with intensive farming has received little attention.

However, evidence of how such a broad strategy can affect breeding bird numbers and diversity (as well as other plant and animal groups) has been gathered since the mid 1980's on a grassland farm in west Wales. These studies, whilst quantitative, cannot by their nature represent a series of carefully controlled trials. We also acknowledge that the economic consequences of the changes made in farming practice are not dealt with here: this study simply demonstrates what can be achieved by restoration of a relatively small area of farmland.

Denmark Farm Conservation Centre (Grid Ref: SN 587537) is a 16.2 ha (40 acre) holding near Lampeter at 180-225m above sea level which, until 1985, was a conventional intensively managed dairy and sheep grassland farm. Thus the fields largely comprised re-seeded and drained rye-grass leys, cut for hay and intensively grazed, and receiving significant amounts of artificial fertiliser. Hedgerows were depleted with the bases grazed out, although some well developed deciduous trees survived. A few small areas had not been ploughed in living memory, but all had received artificial fertiliser or been drained. As a result, the land supported relatively few plant, insect, or bird species and was typical of much of the farmed land of Wales. In 1987 it was judged by a RSPB representative to be "a very barren place . . . very low in wildlife interest".

At that time the new owners described it as a 'green desert' and were moved to try and restore the natural diversity that such habitats used to exhibit under less intensive regimes. This subsequently led to the foundation of the Shared Earth Trust and a long-term experiment to see what might be achieved in restoring the potential variety of wildlife to such land.

After receiving conflicting advice from many agencies and individuals as to which course restoration should follow, it was decided to aim for maximising the variety of habitat (allowing for limitations of scale), and to assess as far as possible the impact of this approach for various groups of plants and animals. Active intervention was necessary to establish new habitats in parallel with the more passive changes in management directed towards a low input/output regime of organic grassland management. Significantly however, there was no intent to favour one group of animals or plants over any other; in particular, there was no overriding intention to maximise breeding bird numbers.

It was also decided that there would be no active introduction of flora or fauna (other than tree planting). This included not re-seeding the fields.

Where there was conflict of interest, the usual course adopted was one of least intervention. For example, recommendations were made that rough rush pasture be topped to provide improved conditions for Lapwing[1] and to increase floral diversity. This might have been to the detriment of Snipe *Gallinago gallinago* and invertebrates - but no definitive information was available so no action was taken. Similarly, it was suggested that it would be advisable to control corvid numbers - this was not done, but the population appears to have stabilised.

[1] Scientific names of species discussed are given in Table 2.

Although no group was to be favoured, the approach was not one of 'fence it and forget it'. Changes made were in accord with what was generally considered to be good practice for encouraging biological diversity: many of these practices have since been compiled in reviews such as Andrews and Rebane (1994) and RSPB, EN, & ITE (1997).

As well as the planting of woodland and shelter belts, restoration of hedgerows, removal of artificial drainage, elimination of chemical inputs, creation of 'scrape' ponds etc., the same diversification policy was applied to the field management with the aim of developing a range of grassland communities. Thus some of the land has been regularly cropped for late hay whilst other areas have been allowed to develop as rough tussocked pasture.

During this time, changes in plant, insect, mammal and bird communities have been monitored. It is not possible to isolate variables in this process of restoration but apart from the general pattern outlined above, the following have been of particular relevance to some bird species:

a) Between 1985-92 all remaining hedgerows were fenced off to provide an ungrazed belt 2-5m wide (at least), either side of the hedges. This was allowed to develop as rough grassland and scrub.

b) Between 1985-91, 4.9 ha of woodland and shelterbelt were planted primarily with mixed deciduous trees (oak, ash, beech, and birch etc.) at a density of about 1500 per hectare (600 per acre).

c) In 1989 approximately 50 nestboxes were set up and this number was increased to about 100 by 1992. The large majority of these were of the type suitable for tits, Pied Flycatcher etc. with a few more specialised types suitable for owls, Kestrel and Robin etc.

During this period the only significant change in the adjacent intensive farmland has been the extension of improved grassland and loss of rush pasture. This surrounding land is now mostly rye-grass dominated fields of under 8 ha (20 acres) with small areas of woodland and conifer plantation.

Monitoring of bird populations has been carried out throughout this process. This monitoring has concentrated on breeding birds, but the importance of such habitats as feeding grounds outside the breeding season should not be underestimated. Many non-breeding species are regularly seen to use the farm during the winter (Heron *Ardea cinerea*, Snipe, Woodcock *Scolopax rusticola*, raptors, and winter visitors such as Fieldfare *Turdus pilaris*, for example). Also, the monitoring discussed below shows irregular use of the land for feeding by a range of additional species during the breeding season.

METHODS

Bird Monitoring programmes

Surveys of breeding birds have comprised two parts, carried out in parallel, which will be considered separately below.

a) An annual survey of breeding birds on Denmark Farm alone has been made since 1985. From 1985-89 this largely comprised records of species known to be breeding but with irregular records of numbers of pairs. From 1990-99 a numerical estimate of breeding pairs was recorded. This will be referred to as the **Breeding Bird (BB)** monitoring. (Not to be confused with the British Trust for Ornithology (BTO) 'Breeding Bird Survey').

b) From 1992-99, breeding pairs on both Denmark Farm and 29.5 ha (73 acres) of adjacent intensively farmed grassland were recorded as part of the BTO Common Bird Census (CBC). This will subsequently be referred to as the **CBC** monitoring.

Since 1990, both surveys have been based on the methodology used for the CBC. In essence, a defined route is walked regularly from mid March to the end of June with records being mapped of all species' song, calls, and movements. These records are then used to compile breeding territory maps. This analysis has been carried out by the BTO to produce the breeding numbers given below. A few species (e.g. Red Kite, or Raven) may not nest on site, but are counted as 'breeding species' in the estimate if the BTO analysis deems them to be using the site as part of their regular breeding/feeding territory. Further information on this type of census and discussion of its limitations are given in Marchant *et al* (1990).

The two studies (BB and CBC) have been carried out concurrently and overlap for the Denmark Farm area, but they differ in the intensity of monitoring. The primary requirement of the CBC study has been to derive a consistent index compatible with other national data collected yearly by the BTO. The BB study, restricted to Denmark Farm, has endeavoured to assess more accurately the actual number of breeding birds by more frequent (up to 15) visits and more lengthy monitoring than the standard CBC (10 visit) method. These are both estimates derived from consistent sampling rather than actual total numbers. It is probable but not provable that actual numbers exceed the estimated values.

Denmark Farm is divided into smaller fields or bounded compartments than the adjacent land. There are effectively 7 grazed areas plus 2 main blocks of scrub and woodland on Denmark farm ranging from 0.6 to 2.6 ha each along with other smaller areas of shelter-belt, a lake etc. (total 16.2 ha). The adjacent intensively farmed area comprises 7 bounded fields of 3.1 to 5.8 ha (total area 29.5 ha).

RESULTS

Changes on Denmark Farm 1985-99 (BB monitoring)

During the first 4-5 years, resources were not available to carry out the time consuming mapping of territories necessary for realistic assessment of breeding bird numbers, but basic records of species present and breeding on the site were compiled. More detailed annual monitoring of birds on Denmark Farm started in 1990. Analysis of these post 1990 surveys was carried out by the BTO to provide the breeding numbers given below along with the earlier data. The following table shows the large and sustained increase in both the number of breeding pairs and the number of breeding species during the period of farmland restoration on the 16.2 ha of Denmark Farm.

Table 1. Breeding bird population estimates at Denmark Farm during 1985 to 1999.

	1985	*86*	*87*	*88*	*89*	*1990*	*91*	*92*	*93*	*94*	*95*	*96*	*97*	*98*	*99*
No: of species	15	17	21	24	29	31	31	37	46	48	44	40	47	50	48
No: of pairs						96	124	156	192	222	208	196	205	249	230

The changes are seen more clearly if the same estimates are expressed as percentage indices (Figure 1). These increases average a 'year on year' rate of change of +9.2% per annum during 1985-99 (+5.6% for 1990-99) in number of species, and +11.1% per annum in number of pairs during 1990-99.

These changes are the product of numerous fluctuations in individual species numbers which cannot be detailed here. However, a broad picture of the species involved and changes in breeding status is given in Table 2. The listing is ranked by breeding frequency in 1999. The estimate of number of breeding pairs is given (where known) at the start of the programme in 1985, for 1990 (when fuller recording started), and for the most recent recorded year (1999). Those species for which there are no positive entries shown were recorded as breeding in some of the intervening years, but not in the particular years shown.

The provision of nest-boxes has probably affected the numbers of a few species. In any

Table 2. Number of pairs of breeding birds in given years at Denmark Farm, as shown by BB monitoring. B = breeding but numbers not known, * = using site as part of breeding or feeding area. For definition of BB monitoring see Methods.

		Number of pairs		
Species		*1985*	*1990*	*1999*
Robin	*Erithacus rubecula*	B	7	21
Willow Warbler	*Phylloscopus trochilus*	1	6	21
Blue Tit	*Parus caeruleus*	B	10	18
Wren	*Troglodytes troglodytes*	B	5	18
Chaffinch	*Fringilla coelebs*	B	11	16
Pied Flycatcher	*Ficedula hypoleuca*	0	14	14
Blackbird	*Turdus merula*	B	2	12
Garden Warbler	*Sylvia borin*	0	2	12
Dunnock	*Prunella modularis*	0	0	10
Great Tit	*Parus major*	B	3	8
Goldcrest	*Regulus regulus*	0	0	5
Tree Pipit	*Anthus trivialis*	1	3	5
Blackcap	*Sylvia atricapilla*	0	1	4
Bullfinch	*Pyrrhula pyrrhula*	0	0	4
Goldfinch	*Carduelis carduelis*	0	2	4
Magpie	*Pica pica*	B	2	4
Nuthatch	*Sitta europaea*	0	0	4
Song Thrush	*Turdus philomelos*	0	0	4
Wood Pigeon	*Columba palumbus*	0	2	4
Carrion Crow	*Corvus corone*	0	2	3
Greenfinch	*Carduelis chloris*	0	0	3
Long-tailed Tit	*Aegithalos caudatus*	0	1	3
Mallard	*Anas platyrhyncos*	0	1	3
Redpoll	*Carduelis flammea*	0	0	3
Coal Tit	*Parus ater*	0	0	2
House Sparrow	*Passer domesticus*	B	2	2
Mistle Thrush	*Turdus viscivorus*	0	1*	2
Buzzard	*Buteo buteo*	0	1*	1*
Canada Goose	*Branta canadensis*	0	0	1
Cuckoo	*Cuculus canorus*	0	0	1
House Martin	*Delichon urbica*	2	0	1
Jay	*Garrulus glandarius*	0	0	1*
Kestrel	*Falco tinnunculus*	0	0	1*
Linnet	*Carduelis cannabina*	0	0	1
Little Grebe	*Tachybaptus ruficollis*	0	0	1
Marsh Tit	*Parus palustris*	0	0	1
Meadow Pipit	*Anthus pratensis*	0	1	1
Moorhen	*Gallinula chloropus*	0	0	1
Pied Wagtail	*Motacilla alba*	1	1	1
Raven	*Corvus corax*	0	0	1*
Red Kite	*Milvus milvus*	0	0	1*
Redstart	*Phoenicurus phoenicurus*	B	4	1
Sedge Warbler	*Acrocephalus schoenobanus*	0	0	1
Siskin	*Carduelis spinus*	0	0	1
Swallow	*Hirundo rustica*	5	3	1
Tawny Owl	*Strix aluco*	0	0	1*
Tree Creeper	*Certhia familiaris*	0	1	1
Whitethroat	*Sylvia communis*	0	2	1
Barn Owl	*Tyto alba*	0	1	0

Species		Number of pairs 1985	1990	1999
Chiffchaff	*Phylloscopus collybita*	0	0	0
Curlew	*Numenius arquata*	0	1*	0
Great Spotted Woodpecker	*Dendrocopos major*	0	0	0
Jackdaw	*Corvus monedula*	0	0	0
Lapwing	*Vanellus vanellus*	0	0	0
Reed Bunting	*Emberiza schoenichus*	0	0	0
Rook	*Corvus frugilegus*	0	0	0
Skylark	*Alauda arvensis*	0	1	0
Sparrowhawk	*Accipiter nisus*	0	0	0
Spotted Flycatcher	*Muscicapa striata*	0	0	0
Starling	*Sturnus vulgaris*	B	0	0
Stock Dove	*Columba oenas*	0	2	0
Swift	*Apus apus*	0	0	0
Whinchat	*Saxicola rubetra*	0	1	0
	Total Breeding Pairs	**-**	**96**	**230**
	Total Breeding Species	**15**	**31**	**48**

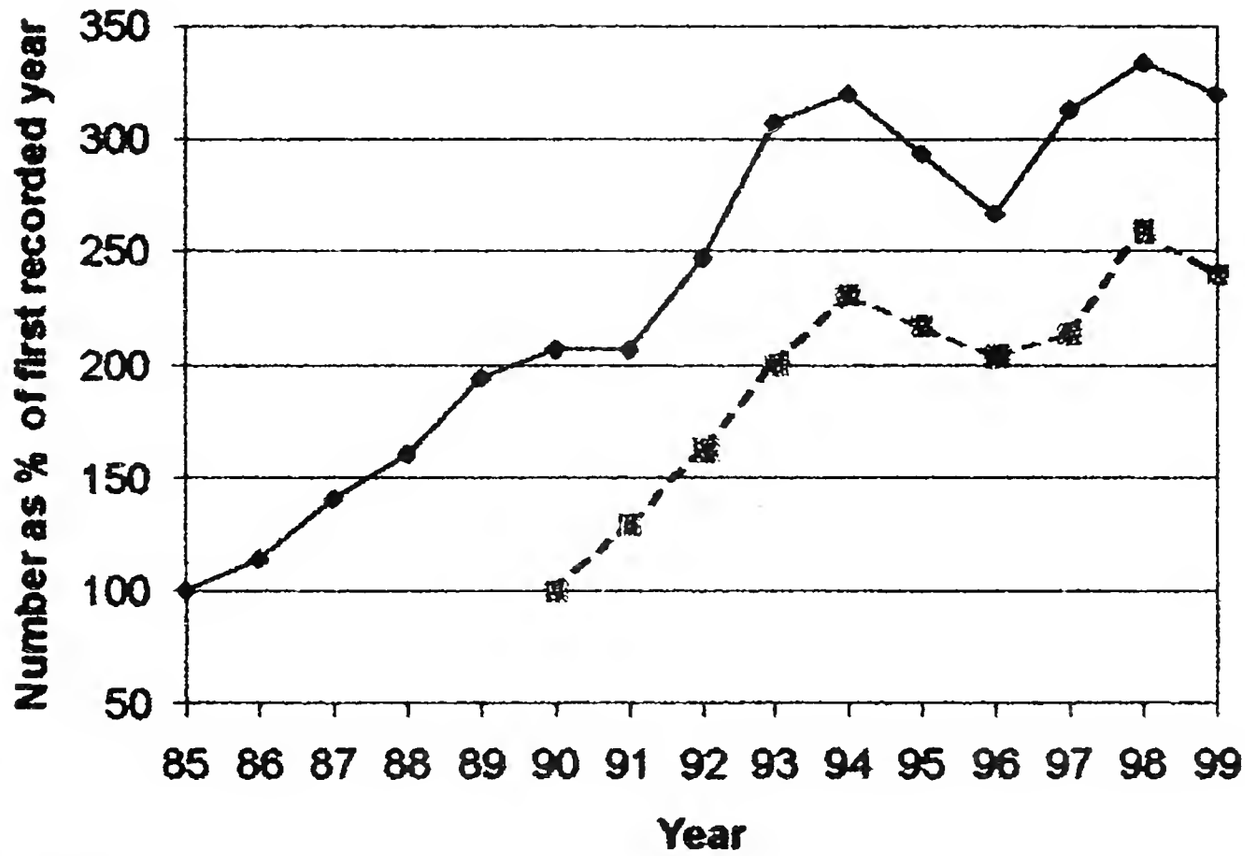

FIGURE 1: Index of changes in breeding bird populations at Denmark Farm during 1985-1999. Estimated numbers are represented as a percentage of the value for the earliest recorded year for each data series. For definition of BB monitoring see Methods.

–●– BB species --■--BB pairs

given year, about 35-40% of 100 boxes are occupied. In the five years 1995-99, the proportional use of the standard boxes occupied was: Blue Tit 42%, Pied Flycatcher 37%, Great Tit 17%, Nuthatch 4%. In addition, a few specialised boxes have been used by single pairs of: Barn Owl, Tawny Owl, Kestrel and Robin.

Changes on Denmark Farm Compared to Adjacent Intensive Farmland 1992-99 (CBC Monitoring)

As described above, the 16.2 ha of Denmark Farm have also been monitored as part of

the CBC, but this longer transect also included 29.5 ha of fairly uniform intensively farmed grassland, contiguous with the Denmark Farm site. As far as possible, all habitats are monitored on both sites with standardised thoroughness. The data derived from the territory maps are then separable into the two differently managed areas. The indices derived for Denmark Farm are all lower than those recorded in the Breeding Bird survey discussed above due to the reduced time and frequency of visits. There is however, a good correlation between the two sets of Denmark Farm data (Spearman Rank Correlation Coefficients: number of pairs $r_S = 0.875$, $n = 8$, $P<0.02$; number of species $r_S = 0.756$, $n = 8$, $P<0.05$). The actual estimates for the two sites are shown below but are not directly comparable due to the differing areas. The lower breeding density on the Intensive Farm is nevertheless evident (Table 3).

Table 3. Estimates of number of pairs of breeding birds from CBC monitoring (see Methods) at Denmark Farm (16.2 ha) and adjacent intensive farm (29.5 ha) during 1992-1999.

Denmark Farm	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
No: of species	34	38	41	39	32	41	40	39
No: of pairs	139	167	180	167	149	163	186	241
Intensive farm								
No: of species	17	22	21	22	14	12	21	17
No: of pairs	47	48	46	63	39	29	49	43

A more direct comparison is possible if the estimates are converted to 'number per hectare' (Figures 2 and 3).

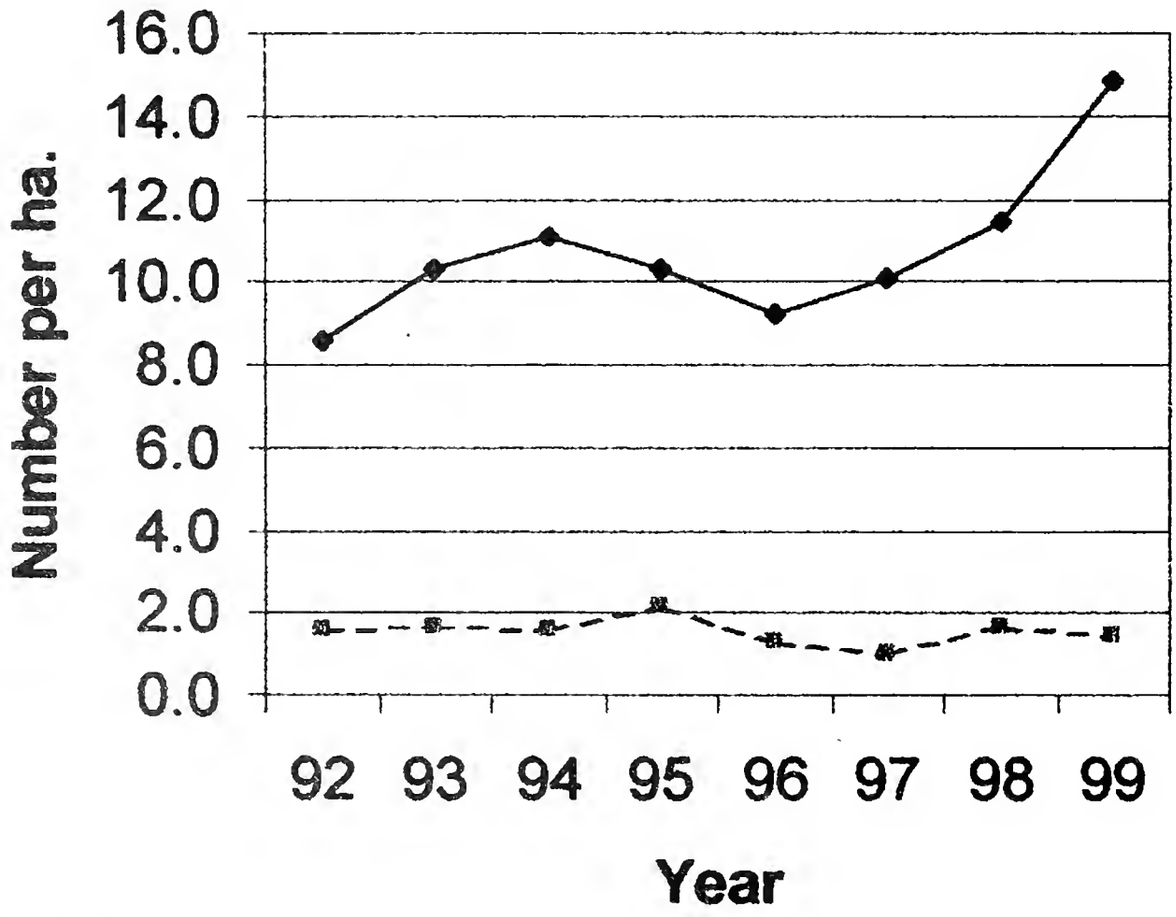

FIGURE 2: Estimate of the number of breeding pairs of **birds** per ha at Denmark Farm compared with adjacent intensive farmland during 1992-1999.

–●– Denmark Farm --■--Intensive Farm

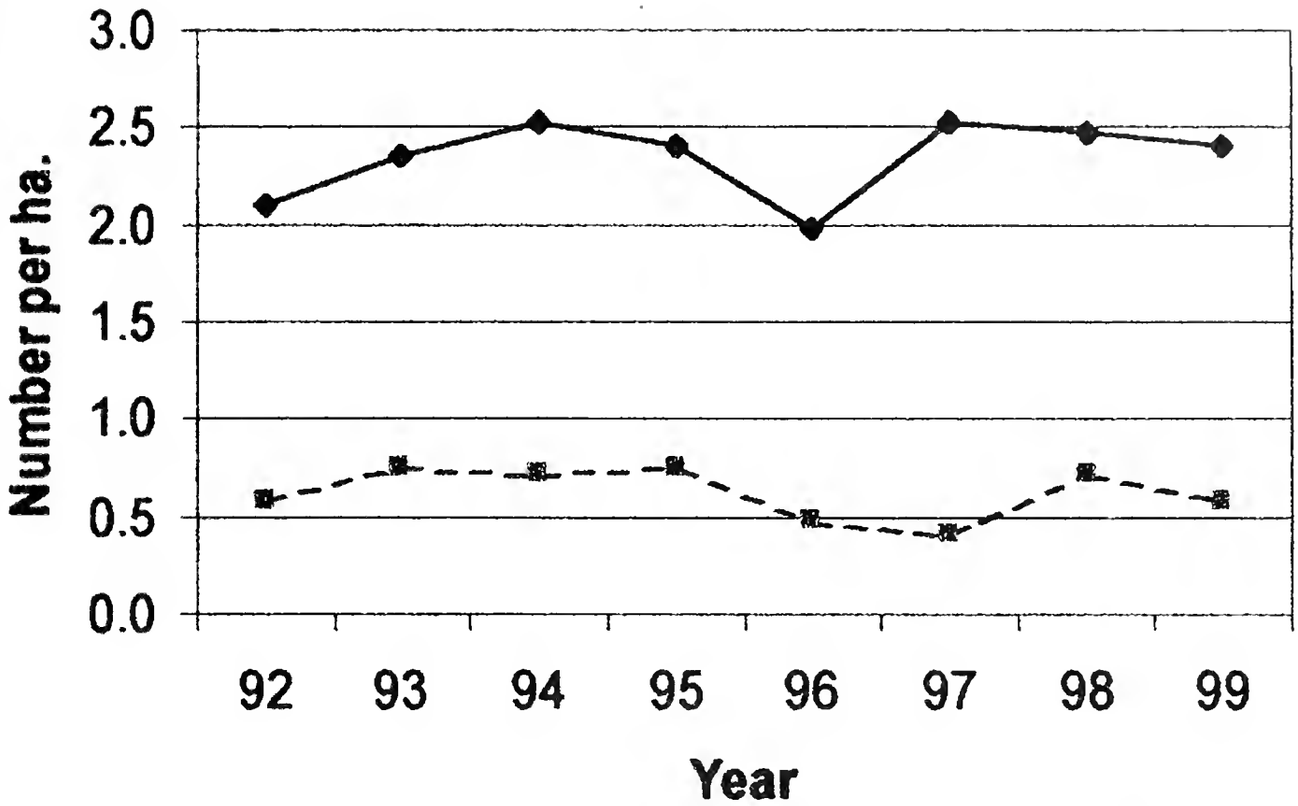

FIGURE 3: Estimate of the number of breeding bird **species** per ha at Denmark Farm compared with adjacent intensive farmland during 1992-1999.

–●– Denmark Farm --■--Intensive Farm

There is no significant correlation between fluctuations in the numbers of pairs or species on the two sites, which would have been expected if some independent variable (such as climate) had been causing changes in a uniform way (Spearman Rank Correlation Coefficients: number of pairs $r_S = 0.244$, n = 8, ns; number of species $r_S = 0.048$, n = 8, ns).

Breeding numbers are not available for Denmark Farm in 1985, before restoration began, but data from the Breeding Bird surveys suggests about 0.9 species per ha at that time (see Table 1, above). The implication is that the bird population on Denmark Farm in 1985 was in a similar depleted state to that found currently on the Intensive Farm (Fig. 3, above). However, this assumption has to be viewed with caution as the method of assessment was different in the two cases.

DISCUSSION

The two sets of survey records suggest that restoration of depleted intensive farmland can result in a rapid increase in a broad range of bird species using that land. Whilst there is no direct evidence to prove that this is not simply an influx of individuals from the surrounding countryside it seems highly unlikely that changes in numbers on the site do not represent a significant and real increase in the overall breeding population.

The fact that the increases observed during restoration on Denmark Farm have not been paralleled by increases on adjacent intensively farmed land strongly suggests the restoration process has resulted in the large and sustained increase in breeding birds.

Whilst it is not surprising that birds start to breed in suitable habitat, what is notable is the rate and magnitude of increase.

- In 15 years, the number of breeding species per ha has more than tripled, and is currently (1999) about 4 times that found on surrounding farmed grassland (2.4 : 0.6 species per ha).
- The numbers breeding have increased to about 10 times those found on adjacent land (14.9 : 1.5 pairs per ha).

It is possible to associate some changes in numbers of particular species with specific factors. For example, in 1988 there were no Pied Flycatchers breeding. Three years later, after the provision of nest-boxes, there were 20 breeding pairs on Denmark Farm. Again, between 1985 and 1998 the pairs of Willow Warbler increased from 1 to 28. Review of territory maps clearly shows progressive occupation of open canopy woodland and hedgerow habitats as these developed. This reflects the generally greater increase (of perhaps 250%) since 1990 in what may be broadly considered more 'woodland' species compared to increases in 'other' species on the site (about 100%).

It must be borne in mind that, in many respects, Denmark Farm is an ecological island, and that this may restrict many species which depend on more scattered meta-populations for long-term stability. Despite apparently suitable habitat, some species have bred in small numbers for only limited periods (e.g. Skylark and Whinchat). It may well be that unless localised restoration can be extended or linked-up over much larger areas, stable populations of some species may never develop. In short, isolated restoration of the often small farms and fields typical of many parts of Wales may be of more benefit to woodland species for example than to field species such as Lapwing.

However, the broad increases which have been observed in some 50 species must be attributable not only to available nesting sites but also to available food - throughout the year for some species. Other less obvious factors must also be having effect and it is noteworthy that other monitoring at Denmark Farm has shown increases in numbers and diversity of plants, invertebrates, and small mammals of similar or greater magnitude than the changes observed in bird populations.

The increases of the first 8-10 years (Fig. 1, above) show how rapidly many species can respond - given the opportunity - to changes made to the most unpromising farmland. The balance of species will doubtless change as the habitats continue to develop, and some species may require change on a more extensive scale if numbers are to increase and sustainable populations develop.

However, this monitoring does suggest that following a broad policy of maximising overall biodiversity can be highly effective in increasing the breeding bird populations of an all too common type of intensively farmed grassland. It also highlights the impoverishment of bird populations brought about by intensive grassland farming.

ACKNOWLEDGEMENTS

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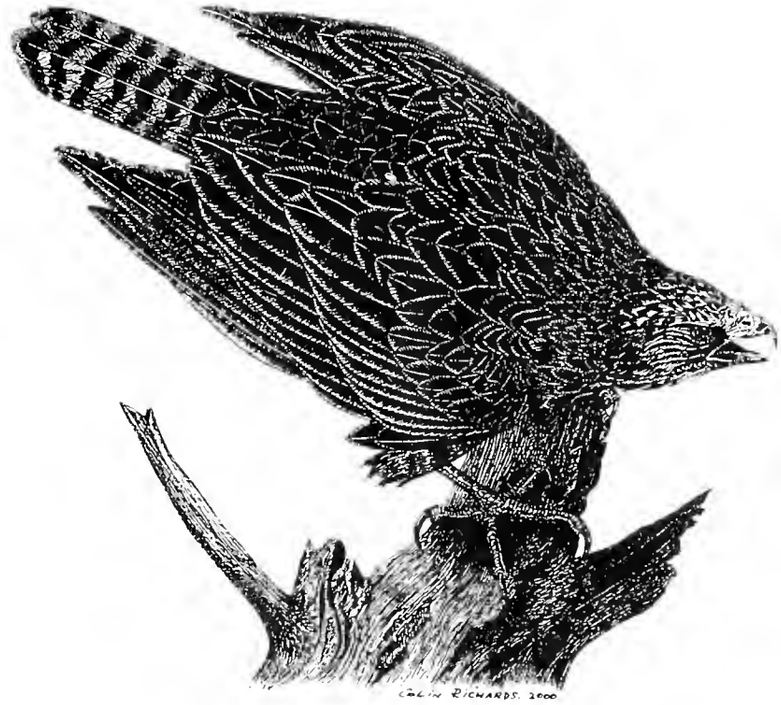

AN INCREASE IN THE BUZZARD *Buteo buteo* POPULATION IN NORTH BRECONSHIRE

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SUMMARY

Counts of soaring Buzzards were made in 4 10-km squares in north Breconshire in 1983 and 1999, using the methods of Taylor *et al* 1988. In 1983 106 birds were counted in 47 tetrads, which had increased to 228 in 71 in 1999. In both years enclosed farmland was the preferred habitat type and areas where this adjoined other major habitat types were also selected. Possible reasons for the increase are discussed.

INTRODUCTION

In 1983 the British Trust for Ornithology (BTO) carried out a Buzzard (*Buteo buteo*) survey in Britain and Northern Ireland. Part of this survey comprised making counts of soaring Buzzards between Mar. 1st and Apr. 18th, to provide a basis for estimates of population density (Taylor *et al* 1988). In north Breconshire Martin Peers made counts covering 4 10-km squares, SN 84 (less 7 tetrads which lie outside Breconshire), SN 85, SN 94 and SN 95, a total area of 372 km^2. Suspecting that a significant increase in the Buzzard population of the area, in which I now live, may have occurred, I repeated these counts in 1999.

METHOD

Study area

The study area comprises 3 main habitat types, coniferous forestry plantations, open hill grazings, very little of which includes heather (*Calluna*), and enclosed farmland. The enclosed farmland is almost entire improved grass mainly devoted to sheep farming, although many farms still carry a few cattle. It also includes frequent hedges and a scatter of small deciduous woods and copses, shelter belts, areas of *rhos* pastures and common which are woven through the habitat matrix. Most of the forestry is first generation, maturing by 1983 and now being extensively felled in some areas, but the Crychan Forest, in the south of SN 84 was established before 1939 and is now entering its third cycle. Table 1 sets out

estimated areas in ha of each of these main habitat categories by 10-km square. The areas were estimated by eye for each tetrad from the 1:25,000 O.S. maps.

The area lies mainly above 300m altitude and rises to 641m on Drygarn Fawr. Altitude was examined by noting the highest point in each tetrad shown on the O.S. maps. Only 17 tetrads were wholly below 300m and only 8 wholly below 250.

Table 1. Summary of broad habitat types in 4 10-km squares in north Breconshire surveyed for Buzzards in 1983 and 1999.

	Forestry plantations			*Open hill grazing*			*Enclosed farmland*		
10-km square	*tetrads*	*area(ha)*	*%square*	*tetrads*	*area(ha)*	*%square*	*tetrads*	*area(ha)*	*%square*
SN 84	16	2832	39	9	1216	17	15	3152	44
SN 85	22	4448	44	24	5204	52	8	348	4
SN 94	12	528	5	18	5460	55	16	4012	40
SN 95	11	468	5	13	3324	33	21	6208	62

Notes: Many tetrads have elements of more than one habitat type. Only 18 tetrads included in SN 84.

Counting methods

The 1983 counts required up to 3 visits in each 10-km square between Mar. 1st and Apr. 18th and noting the position of each Buzzard engaged in aerial activities in each tetrad (2x2km square). Separate birds or groups of birds were distinguished by dotted lines and movements between tetrads were shown by solid lines. Observers were asked not to count in wet weather or very strong winds, when soaring would be depressed. Time spent on each visit was noted (Taylor *et al* 1988). In 1983 Peers made 10 visits between Mar. 6th and Apr. 9th, totalling 31.5 hours, and averaged 20 minutes per tetrad. In 1999 I spent the same time per tetrad but spread over 12 visits, between Mar. 7th and Apr. 11th, as 2 visits were curtailed by deteriorating weather. Counts were done by a combination of scanning from overlooks and walking through tetrads and care was taken not to record the same tetrad twice. Soaring Buzzards may drift over a wide area, hence the need to record movements, but, in analysing the records, birds were recorded for the tetrad in which they were first seen.

RESULTS

Altogether Peers recorded 106 soaring Buzzards in 47 tetrads in these squares in 1983. In 1999 I counted 228 in 71 tetrads, an increase of 115% in birds and 51% in occupied tetrads. Table 2 shows the results by 10-km square.

Table 2. The number of soaring Buzzards recorded in 4 10-km squares in north Breconshire in 1983 and 1999.

	No: tetrads occupied		*No: soaring Buzzards*		
10-km square	*1983 (%)*	*1999 (%)*	*1983*	*1999*	*% change*
SN 84	11 (60)	13 (72)	19	39	+105
SN 85	7 (28)	18 (72)	13	48	+269
SN 94	15 (60)	19 (76)	38	56	+47
SN 95	14 (56)	21 (84)	35	85	+143
Total	**47 (51)**	**71 (76)**	**106**	**228**	**+115**

Habitat relationships

Comparing Tables 1 and 2 suggests some broad relationships between the numbers of Buzzards and the habitat categories available, particularly in 1983. Thus most birds were then found in enclosed farmland and forestry was the least attractive category. These relationships were examined in more detail on a tetrad basis.

Figure 1 compares the distribution of the main areas of forest, open hill grazings and enclosed farmland with the distribution of soaring Buzzards in both years. The broad relationship between Buzzard numbers and enclosed farmland is quite clear, although the older forest of the Crychan attracted good numbers in 1983. Figure 2 shows that there was a strong tendency for the numbers of Buzzards per tetrad in 1983 to increase with the proportion of enclosed farmland per tetrad. This was still evident in 1999 but less marked. The correlation in 1983 was not quite statistically significant ($r_s = 0.77$, $n = 6$, $P<0.10$) but no comparable relationship was found between open hill grazings or forestry. This suggests that the concentration in enclosed farmland reflected a habitat preference rather than the influence of another factor, particularly altitude, which was strongly correlated with open

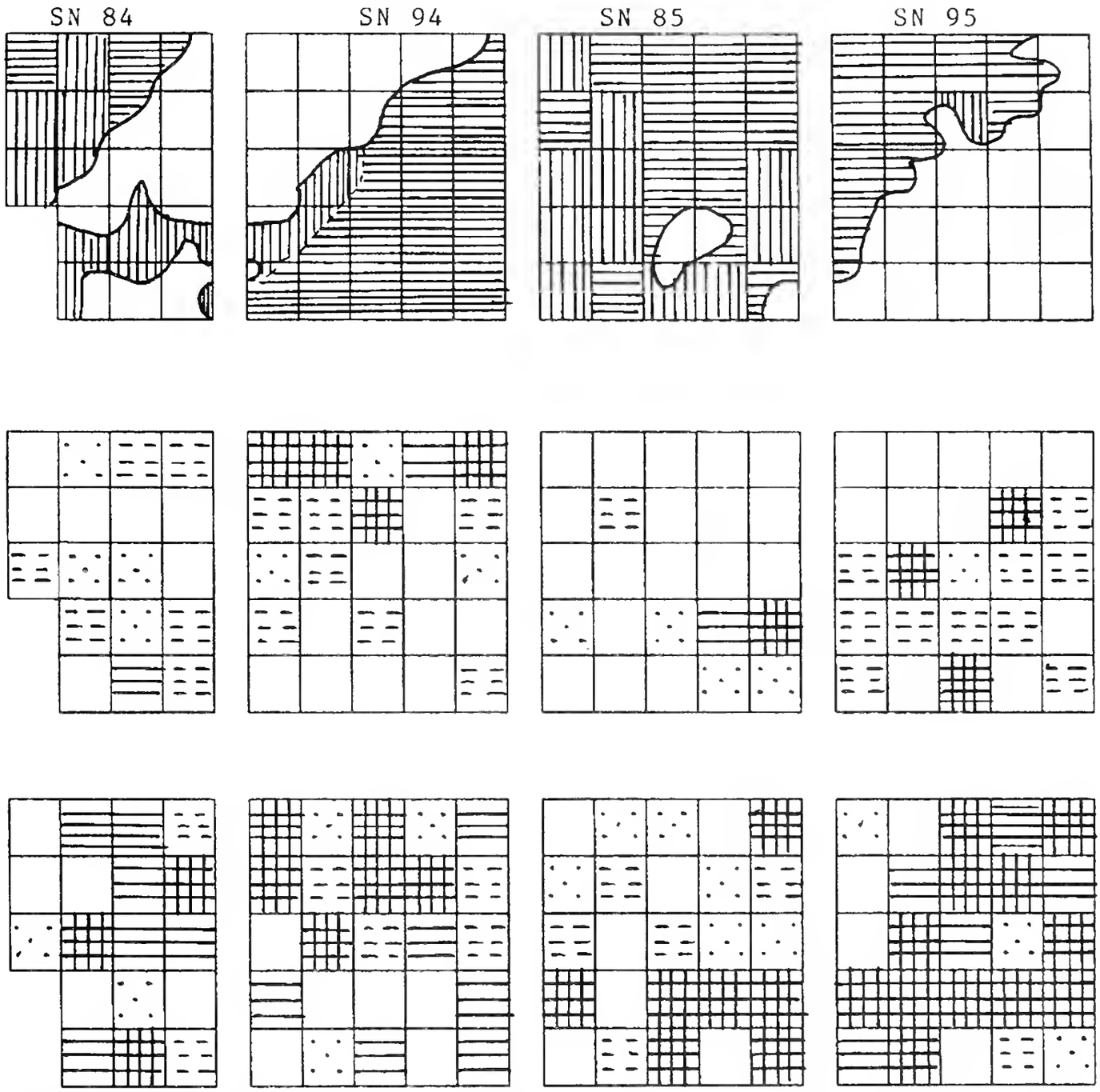

FIGURE 1: Broad habitat categories by tetrad in 4 10-km squares in north Breconshire compared to numbers of soaring Buzzards in 1983 and 1999.

Top: habitat categories. Main areas of enclosed farmland ☐ forestry ▥

open hill grazings ☰

Middle: Buzzards in 1983. None ☐ one ⁘ 2 ⁘ 3 ☰ 4 or more ▦

Bottom: Buzzards in 1999. Shadings as in 1983.

hill and forestry. This was supported further by examining tetrads entirely composed of one habitat category, of which there were 7 for forestry, 22 for open hill grazings and 22 for enclosed farmland. In 1983 numbers of Buzzards were 2, 5 and 36 respectively, significantly different from the numbers expected by chance ($Chi^2 = 26.53$, df 2, $P<0.01$). In 1999 numbers were 12, 35 and 79, again significantly different from expectation ($Chi^2 = 22.94$, df 2, $P<0.01$).

These figures also show the pattern of increase quite clearly, with a marked expansion into areas of open hill and forest in 1999 but the highest densities still concentrated in enclosed farmland.

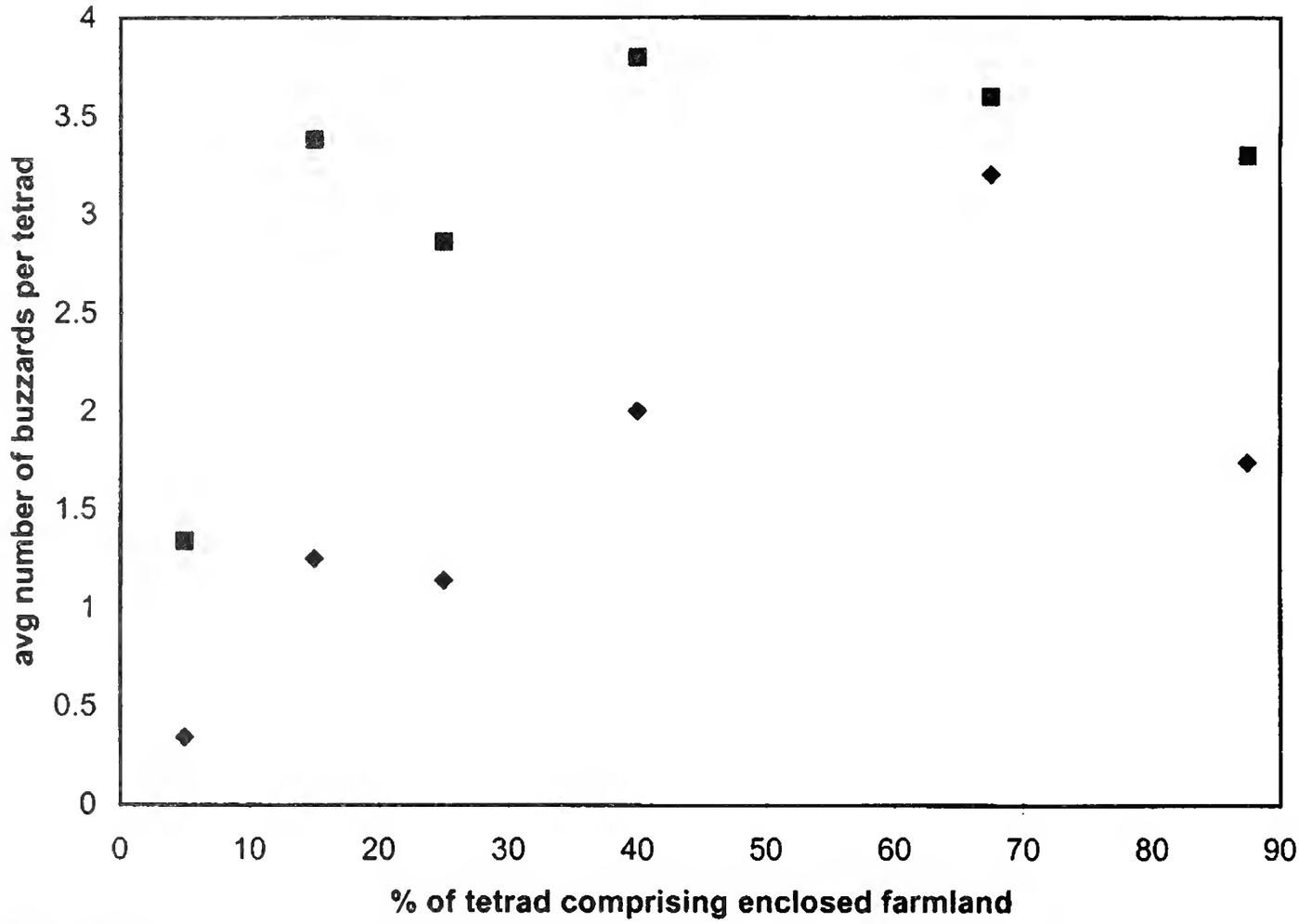

FIGURE 2: Number of Buzzards per tetrad in 4 10-km squares in north Breconshire compared to the percentage of enclosed farmland per tetrad. ◆ 1983 ■ 1999

Examination of the records used for Figure 1 also shows another significant habitat relationship. In 23 tetrads (25% of the total visited) enclosed farmland abutted open hill or forest along an edge stretching across much of the square. These tetrads seemed particularly favoured by Buzzards, attracting 45 birds (42% of the total) in 1983 and 79 (35%) in 1999. These were significantly higher values than expected by chance (1983 - $Chi^2 = 17.44$, df 1, $P<0.01$, 1999 - $Chi^2 = 11.98$, df 1, $P<0.01$).

DISCUSSION

A possible source of bias must be taken into account in considering the increase in Buzzards shown here. Soaring activity by Buzzards in spring is largely territorial and soaring by one bird or pair often triggers soaring by others (*pers. obs.*). Hence increased numbers of Buzzards probably increase the level of soaring activity and therefore their 'visibility factor'. This might overstate the scale of increase. Nevertheless the increase is undoubtedly real, with both a marked expansion into open hill grazings and, to a lesser

extent, forestry and increase in preferred enclosed farmland habitats. Blanket forestry is perhaps the least suitable habitat considered here although, as the trees grew, its presence probably allowed Buzzards to exploit for nesting areas of open hill with few other nest sites. As felling continues to open large continuous areas of forest up, particularly in SN 84, it may encourage some further increase in the area.

There is rather little information about the present status of Buzzards in Wales as a whole, although the species is certainly increasing in Anglesey (Welsh Bird Report 1997). I doubt very much, however, that the increase noted here is peculiar to north Breconshire. Certainly Sim *et al* (2000), in a similar exercise in the West Midlands, on the Welsh border, in 1996, found an increase of 118% in soaring birds since 1983. Their study also examined the relationship between counts of soaring birds in 14 tetrads and numbers of nesting and egg laying birds found there in intensive studies. Numbers of soaring birds did not differ materially from the known nesting population. Whilst these authors noted that this small sample needed treating cautiously, it suggests that soaring counts give a reasonable estimate of the breeding population, at least in areas of high density. Sim *et al* ascribed the increase in their area to a decline in persecution and an increase in rabbits (*Oryctolagus cuniculus*), the latter underpinning an increase in breeding productivity since 1980. In my north Breconshire study area levels of persecution have not been a factor, largely because there are no gamekeepers or game shooting interests. M. F. Peers (*pers. comm.*) considered that rabbits had increased in parts of the area at least but my own empirical observations suggest that their distribution in any numbers remains distinctly patchy at best and I am sceptical of any general increase. This is supported by observations from a local rabbit catcher (W. George *pers. comm.*) who notes a marked decline in the Llanwrtyd and Beulah areas in the past decade, following a long period of population stability. As he remarked, this pattern may be the result of increased predation by Buzzards but it will be interesting to see how Buzzard numbers develop in future.

One other factor should be considered. The 1983 census followed a very severe winter in 1981/82, with heavy snow in north Breconshire. Numbers were probably reduced as a result. Whilst I lack direct evidence of this for Buzzards, Peers noted that all birds were scarce in SN 85 and SN 95 particularly at this period, when he was also doing survey work for the Winter Atlas (Lack 1986). Furthermore Peers also noted that the breeding seasons during 1979-1981 were poor for Buzzards, particularly the last, a very wet summer. I suggest, therefore, that the present increase partly reflects recovery from these factors. It is worth noting that Peers' counts averaged 1.14 Buzzards per tetrad, which was 21% lower than the overall average for Wales noted by Taylor *et al* (1988), supporting the idea that numbers were low. This was particularly so in SN 85, where only 13 birds (0.52 Buzzards/ tetrad) were seen. As Figure 1 shows, this square is mainly open hill and forest and it has a mean maximum altitude of 518m. Thus birds might be particularly vulnerable to severe winter weather there. Numbers in SN 94 and 95 were the same as the overall Welsh average (1.45 Buzzards/tetrad). By 1988-91, the years for the new Breeding Atlas survey, numbers were recovering, with counts then showing an average of 1.92 birds/tetrad for those tetrads visited, with little difference in upland and lowland squares. Significantly more time was spent per tetrad for this survey however.

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COLONISATION AND EXTINCTION OF BIRDS IN WALES, 1945 - 1999.

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SUMMARY

Over the past 50 years, ornithologists have understandably become very concerned at the plight of several British breeding birds which have declined dramatically, principally as a result of increasingly intensive agricultural systems. This paper shows that since 1945, four species have become extinct as regular breeders in Wales but 18 species have colonised this country over the same period. These facts should not, however, detract from the parlous state of many once widespread species that are now on the verge of extinction.

INTRODUCTION

Birds have been present on earth for about 150 million years and throughout this period some species have become extinct whereas others have evolved or been discovered by man, the latter generally in the more remote areas of the world. More recently, DNA analysis has enabled scientists to split what were previously regarded as one species into two or more distinct new species, thus adding to the 8600 or so known species. However, never have birds and other wildlife been so threatened by the actions of man throughout the world than over the past 25 years, principally as a result of agricultural 'improvement', urbanisation and pollution.

The rapid decline of several bird species has now been reasonably well documented over much of Europe (Tucker & Heath 1994), the UK (Gibbons *et al.* 1993) and particularly in Wales (Lovegrove *et al.* 1995). The quality and quantity of data on the status and trends of many bird species in Wales is particularly good due principally to the work of the Royal Society for the Protection of Birds and Nature Conservancy Council (now Countryside Council for Wales) in surveying most of the remoter parts of Wales during the 1970s and 1980s and periodically repeating much of the work more recently. This, along with data collated by the British Trust for Ornithology and local volunteers, has provided excellent

information on most of our threatened species and has highlighted the fact that the Welsh countryside has an impoverished avifauna in many areas because of the dramatic declines of several familiar species over the past 25 years.

This paper, however, will deal with those species that have become extinct as regular breeders in Wales since the end of the Second World War or those that have started breeding regularly here over the same period. 1945 is taken as the cut off point for two main reasons. Firstly, the end of the War saw the formulation of many of the agricultural policies which have proved to be so detrimental to wildlife and which are still in place today. Secondly, from around 1945 onwards, bird recording improved throughout Britain and although Wales is still poorly covered in some areas, there is considerably more data for the period 1945-1999 than any period prior to this (Lovegrove *et al.* 1994).Species such as Hen Harrier (*Circus cyaneus*) that recolonised Wales during the period following a fairly brief extinction (Williams 1999) are omitted. Also omitted are species that are believed to have become extinct as regular breeders prior to 1945 but which nested occasionally afterwards (*eg* Cirl Bunting *Emberiza cirlus*) and those which probably started breeding regularly before 1945 (*eg* Twite *Carduelis flavirostris*). Sporadic breeders such as Scaup (*Aythya marila,* nested once in 1972), Dotterel (*Charadrius morinellus,* nested at least 3 times since 1968), Hoopoe (*Upupa epops,* bred 1996), Black Redstart (*Phoenicurus ochropus,* probably nested at least twice in the 1980s), Marsh Warbler (*Acrocephalus palustris,* bred 1972) and Dartford Warbler (*Sylvia undata,* bred 1998) have also been omitted, although the last may become a regular breeder in the near future. Also left out are those species which nested regularly after 1945 but are now extinct again, Bittern *(Botaurus stellaris),* Marsh Harrier *(C. aeruginosus),* Montagu's Harrier *(C. pygargus),* Common Gull *(Larus canus),* Firecrest *(Regulus ignicapillus)* and Bearded Tit *(Panurus biarmichus).* Several of these should recolonise Wales in the near future, particularly some of the marshland birds.

EXTINCTION

Extinction in this instance is defined as a species which no longer bred regularly in Wales after 1945, even if scattered breeding records have been noted periodically. Due to the relatively poor coverage for some species and the difficulty in surveying others, the exact date of extinction is not always known but the most accurately known date is given in the text.

i) **Corncrake** *Crex crex* - The decline of the Corncrake in Wales has been well documented (Lovegrove *et al.* 1995), as have the reasons for its rapid decline throughout Britain (Green 1994) and, more recently, most of north west Europe (Tucker & Heath 1995). In Wales, the decline was already well underway in some southern counties by the 1920s and, by 1970, regular breeding had ceased in all but a few western areas and the Severn valley. Throughout the late 1980s and early 1990s, sporadic probable breeding records were noted in north east, north west and south west Wales and the last confirmed record comes from Rhosllanerchrugog near Wrexham in 1992 when a female with 3 chicks was seen in a hayfield. The Corncrake is now declining rapidly throughout western Europe and it is therefore likely to remain no more than a passage migrant to Wales with occasional breeding.

ii) **Woodlark** *Lullula arborea* - In the early 19th century, the Woodlark is believed to have been widespread in most Welsh counties (Parslow 1973) but it declined during the second half of the century. Despite a brief resurgence in some Welsh counties between the 1920s and 1940s, numbers declined thereafter, particularly following the harsh winters of 1961-62 and 1962-63, and the last known pair bred near Builth Wells in 1980 or 1981. There is some hope that Woodlarks may once again become regular breeders in Wales as this species is increasing in parts of southern England, partly due

to the availability of clearfell areas in conifer plantations. Nightjars *(Caprimulgus europaeus)* have colonised such areas throughout Wales and there is no apparent reason why Woodlarks could not expand their range in this way.

iii) **Red-backed Shrike** *Lanius collurio* - A century ago, the Red-backed Shrike was widespread in lowland areas throughout Wales, particularly in the north, but even at that time, the population was in decline in many areas. Its subsequent demise as a breeding bird in England and Wales has been well documented (Peakall 1962) and is attributed to long term climatic changes, although other, hitherto unknown, factors may have been involved. Regular breeding in Wales ceased around 1950 but there was a brief resurgence during the 1980s with probable breeding pairs in at least two counties. Since that time, however, the Red-backed Shrike has become extinct as a regular breeding species in the UK.

iv) **Nightingale** *Luscinia megarhynchos* - The fourth and final species which has disappeared as a regular breeder from Wales since 1945 is the Nightingale, a small thrush which thrived in the past in coppiced woodlands, a traditional management technique which has all but died out in Wales. Its extinction in this country has been reflected in other peripheral parts of its range in northern and eastern Europe and it is therefore unlikely to recolonise in the near future. Only 60 years ago, the Nightingale was a scarce but regular breeder in most of the counties along the English border and Glamorgan, and on at least one occasion in Carmarthenshire. The prominence of place names containing the word 'Eos' (the Welsh name for the Nightingale) is testimony to the fact that it was once widespread, especially in the east and south of the country, but regular breeding finally ceased in the early 1980s in Monmouthshire and Glamorgan.

Thus we see that four species have become extinct in Wales between 1945 - 1998, a farmland rail, a woodland passerine, a farmland passerine and a farmland/woodland passerine. Two further species, the Corn Bunting *(Miliaria calandra)* and Turtle Dove *(Streptopelia turtur)* are worthy of note here as both have only a tenuous foothold in the Principality. The former was once widespread throughout lowland Wales, particularly along the coastal strip where arable farming was most common, but it declined with the demise of such agriculture from the end of the 19th century onwards. Today, less than 4 pairs of Corn Buntings remain in the coastal strip of Flintshire on the edge of the Dee estuary (G.A. Williams *pers. comm.*). Even rarer however, is the Turtle Dove with probably only 1 or 2 pairs remaining in eastern Monmouthshire. Numbers have fluctuated widely throughout the 20th century although it was never a common species in Wales and there is little doubt that this will be the next species to be lost as a regular breeder early in the new Millennium.

Between 1945 and 1999, however, 18 species exploiting a variety of different habitats have become regular breeders in the Principality. The dates of first breeding, as far as is accurately known, are recorded below.

COLONISATION

1945 – Fulmars *(Fulmarus glacialis)* had been expanding their range southwards from their single breeding station on St. Kilda for many years (Fisher 1952) and may have bred in Wales prior to 1945. However, it was in this year that a pair with one egg was discovered on the Great Orme near Llandudno and since then, Fulmars have spread to nest on rocky cliffs around the Welsh coastline and in some counties, pairs now nest on quarries, up to one kilometre inland. The Seabird Colony Register recorded 2472 apparently occupied sites in 123 localities around the Welsh coast in 1987.

1950 – Lady Amherst's Pheasants *(Chrysolophus amherstiae)* were first introduced into England from south-east Asia in 1828 but it was not until 1950 that a dozen birds were

taken from Woburn in Bedfordshire and released in the grounds of Halkyn Castle in Flintshire. Here, the small population flourished for many years due to the presence of gamekeepers but more recently, the population has declined and there are now believed to be no more than ten individuals remaining

Although Pochard *(Aythya ferina)* were first recorded nesting in Wales at Llyn Tegid in 1906, regular breeding probably did not occur until the early 1950s when pairs were noted on some of Anglesey's eutrophic lakes and Llyn Llywenan in particular. During the second half of the 20th century, the Pochard population in Wales increased slowly in both numbers and range, and even by the end of the century, regular breeding is confined to a handful of sites, principally on Anglesey, but with good numbers also in Glamorgan and Carmarthenshire.

1953 – Red-breasted Mergansers *(Mergus serrator)* had expanded through Scotland and northern England prior to the 1950s and although pairs had been seen in suitable habitat in Wales from the 1920s onwards, breeding was not proven until a nest with eggs was found on Anglesey. Expansion over the next 20 years was gradual and by 1980, pairs were nesting along the coast as far south as Ceredigion. Since then, the southward spread has continued and breeding has been recorded inland on many of the major Welsh rivers (Griffin 1990).

1961 – Hobbies *(Falco subbuteo)* have bred intermittently in Wales for some time but it was not until this year that pairs began to nest regularly. Although the original pair nested in Radnorshire, the species became established over the next 30 years in the neighbouring county of Monmouthshire with 6 or more pairs now recorded in some years (S.J. Roberts, *pers. comm.*). Over the past decade, breeding has been suspected or confirmed in at least five other vice-counties although Monmouthshire remains the species' stronghold. The total Welsh population is likely to be in excess of 30 breeding pairs.

Another species to colonise Wales in this year was the Collared Dove *(Streptopelia decaocto)* although breeding had first been recorded in England in 1955 after a rapid expansion in range through north western Europe. Breeding pairs were recorded in Meirionnydd and Pembrokeshire in 1961 and the subsequent colonisation of lowland Wales was rapid with no apparent east to west trend. Carmarthenshire and Breconshire were apparently the last two counties to be colonised, in 1968 and 1969 and today this is a widespread species in lowland Wales.

1962 – Although Crossbills *(Loxia curvirostra)* had nested intermittently in Wales during irruption years, it was not until 1962 and subsequently that breeding occurred with any regularity. A large influx from Scandinavia in that year resulted in the colonisation of the thousands of acres of suitable habitat in the form of mature coniferous woodlands. After a further influx in 1991, Crossbills became regular breeders in most counties and although numbers now vary from one year to the next depending largely on the cone crop, Crossbills are now widespread in Wales.

1964 – It was in this year that Golden Pheasants *(Chrysolophus pictus)* were introduced to Pen-y-parc woodlands near Beaumaris on Anglesey and a few years later, more birds were released at Herron Farm on the Bodorgan Estate near Newborough, again on Anglesey. This species, a native of central China but originally introduced into Britain in the 18th century, has survived on Anglesey as a result of intensive 'keepering and the population is now believed to number some 30-35 individuals.

1969 – Goshawks *(Accipiter gentilis)* had disappeared from Wales sometime prior to the end of the 18th century (Lovegrove *et al.* 1994) but throughout the 1950s and 1960s, an increasing number of records were reported from several Welsh counties. Most, if not all, of these were escaped falconers' birds and it came as no surprise therefore when an adult and

fully grown young were seen in Pembrey Forest, Carmarthenshire. The subsequent colonisation of Wales was rapid and by the mid 1990s, the Welsh population was estimated at 300-400 pairs (Wales Raptor Study Group newsletter 1996).

1970 – Goosanders *(Mergus serrator)* had regularly been recorded summering in suitable habitat in Wales since the 1950s as the breeding population expanded from Scandinavia through Scotland and northern England. It was not until 1970, however, that nesting was first proved in Wales at Lake Vyrnwy in Montgomeryshire and since then, the population has increased rapidly with pairs now nesting on every major Welsh river.

Little Ringed Plover *(Charadrius dubius)* colonised England for the first time in 1938 and the species soon began to expand westwards. In 1970, the first Welsh breeding record was noted when a pair with eggs was found in Flintshire. Over the next 10 years, pairs were located on some of the larger shoals on rivers such as the Severn, Tywi and Wye and today, it is estimated that about 100 pairs nest in the Principality, a high percentage of these on the Tywi and its tributaries.

1975 – Gadwall *(Anas strepera)* were first introduced to Britain at Dersingham in Norfolk in 1850 and, despite a record of a summering pair in Caernarfonshire in 1927, it was not until 1969 that a pair finally bred in Wales at Margam (Glamorgan). This, however, was an isolated record and although there were sporadic breeding records from several counties over the next few years, it was not until 1975 that regular breeding was noted on Anglesey. This county, with its shallow, reed-fringed lakes, has proved ideal for this species and today, numbers in the county total at least 40 pairs (G.A. Williams *pers. comm.*).

1976 – Having escaped from the Wildfowl and Wetland Trust's centre at Slimbridge in about 1952, Ruddy Ducks *(Oxyura jamaicensis)* first bred in Wales in 1976 when a female with young was seen on Lymore Pool near Montgomery (Lovegrove *et al.* 1980). From 1978 onwards, breeding has been recorded each year on Anglesey and it is these two counties which still support the majority of the Welsh population which now numbers over 200 pairs. During the 1990s, the UK government, supported by the Countryside Council for Wales, the Royal Society for the Protection of Birds and the WWT, has initiated a culling programme with the long-term aim of eradicating this species because Ruddy Ducks have now reached Spain where they are hybridising with the globally endangered White-headed Duck *(O. leucocephala).* Their long-term future in Wales therefore appears to be in the balance.

1985 – The first confirmed Welsh breeding record for Mandarin Ducks *(Aix galericulata)* came in this year when a pair nested near Kenfig Hill in Glamorgan. A small population had become established along the upper reaches of the River Severn in Montgomeryshire during the early 1980s but breeding was not confirmed here until some time later. Over the last 15 years, breeding has been confirmed or suspected in at least another five counties but the Welsh population is still very small, probably numbering less than 50 pairs.

Cetti's Warblers *(Cettia cetti)* probably bred in Wales as early as the late 1970s but breeding was first proved at Oxwich on the Gower in 1985 when a nest was located. In that year, up to 9 singing males were recorded at this site and since then, singing males have been noted from sites as far north as Anglesey. The only attempt thus far to census the Welsh population was in 1996 as part of an UK-wide survey and in that year, 40-42 singing males were recorded from 19 sites in 5 southern counties (Wotton *et al.* 1998). 1996 was regarded as a poor year for this species in Wales, however, due to adverse winter weather conditions and following a recent succession of mild winters, this species has continued to increase in both range and numbers.

1988 – Pintail *(Anas acuta)* bred for the first time in Wales on Skomer Island in 1988 and

the following year, a pair also bred in Carmarthenshire. Since that time, regular breeding has occurred only on Skomer. The true origin of this small breeding population is unknown but it is suspected that they originate from birds released on the Severn Estuary during the late 1980s.

1992 – Honey Buzzards *(Pernis apivorus)* had been suspected of nesting in Wales several times over the past 120 years but breeding was not proved until 1992. In 1991, a pair had been present at the site but eggs were not laid until the following year. By 1999, breeding had been recorded at five different sites with birds present sporadically at three others and it is likely that this species is still under-recorded in the Principality.

1997 – The most recent species to join the Welsh breeding list is the Eider *(Somateria mollissima)* which first nested on Puffin Island off the south eastern coast of Anglesey in 1997 (Arnold *et al.* 1997). The pair returned in 1998 and 1999 although both attempts were apparently unsuccessful, and in 1998, two pairs nested on the Meirionnydd mainland. In 1999, a pair again attempted to nest on Puffin Island but failed probably due to predation by gulls (R. Arnold *pers. comm.*).

DISCUSSION

Therefore, despite the fact that four species have become extinct as regular breeders in Wales over the past 54 years, a total of 18 have colonised with varying degrees of success. Of the four species which have disappeared, Corncrake, Woodlark and Red-backed Shrike were primarily dependent on farmland and were unable to live with the rapid changes in land use and modernisation of agriculture over the past 100 years or so. The fourth, the Nightingale, was principally dependent on managed broadleaved woodlands and was probably never common in Wales. Whether any of these four species recolonise this country remains to be seen but with both Corncrake and Red-backed Shrike declining rapidly throughout Europe, they are likely to remain no more than rare visitors.

The 18 colonisers are an interesting variety of introduced species and wild birds which have spread across from continental Europe. Honey Buzzards, Hobbies and Goshawks have undoubtedly benefited from better protection, a measure which has also been of great benefit to other raptor species, although the Goshawk was also deliberately introduced by falconers. The two gamebirds, Lady Amhersts' and Golden Pheasant, were also introduced and currently survive only in heavily gamekeepered woodlands whereas several species of duck, namely Gadwall, Pochard, Ruddy and Mandarin Ducks, all expanded their ranges into Wales, often following introductions into England. The three remaining ducks, Goosander, Red-breasted Merganser and Eider, in addition to Fulmar and Crossbill, gradually expanded from Scotland, through northern England and into Wales. Crossbills and Goshawks, in addition to several resident species, have been quick to take advantage of the thousands of acres of mature, exotic coniferous woodlands which now smother a quarter of the Welsh uplands as well as some lowland areas. The Collared Dove, Little Ringed Plover and Cettis' Warbler all expanded across southern England into Wales following rapid population increases on the continent whereas the small Pembrokeshire population of breeding Pintail probably originates from introductions.

In the near future, it is likely that Little Egret *(Egretta garzetta),* once a rare vagrant but now a widespread non-breeding resident in Wales, will join the list of colonisers, as will Dartford Warbler and Woodlark, both of which are increasing in southern England. Large-scale habitat creation, particularly the creation of reedbeds in areas such as Anglesey, Llanelli and Gwent, should see the return of Bittern, Marsh Harrier and Bearded Tits and global warming will undoubtedly cause further colonisation and extinction. However, there is no doubt that the overriding concern in Wales at present is the rapid demise of once

common farmland species such as Lapwing *(Vanellus vanellus)* and Yellowhammer *(Emberiza citrinella).* At the current rates of decline, it will not be long before several other species join the Nightingale, Red-backed Shrike and Corncrake on the list of extinct breeding birds in Wales.

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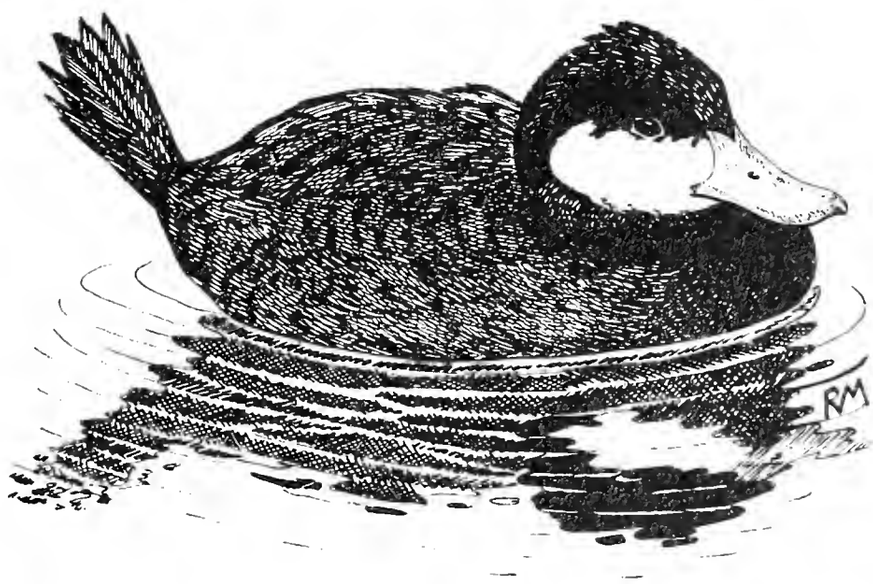

A COMPARISON OF THE DIETS OF SHORT-EARED OWLS *Asio flammeus* AND LONG-EARED OWLS *A. otus* ON A HEATHER MOOR IN NE WALES.

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SUMMARY

Diet of Short-eared Owls on a Welsh heather moor, as follow-up to an earlier paper, and of Long-eared Owls on the same moor's edge, were studied respectively in 1985-1998 and 1991-1999. The Short-eared Owls, breeding only 2-3 times, took mainly birds in a small winter sample, but more Wood Mice and Field Voles and fewer Pygmy Shrews in spring than before 1985. Long-eared Owls were present in all years but were known to breed only twice. In 1609 vertebrate prey items, Wood Mice dominated numerically and by weight, with Pygmy Shrews, Field Voles, Bank Voles and birds also important. Few Common Shrews were taken. Different species dominated diet in different years. Prey varied by season, with mice, Pygmy Shrews and birds important in summer, voles and mice in winter. Causes of non-breeding and possible links to food shortage are discussed.

INTRODUCTION

In Britain the Short-eared Owl *Asio flammeus* and Long-eared Owl *Asio otus* are primarily specialist *Microtus*-eaters, though also known to adopt more "generalist" feeding strategies (Glue & Hammond, 1974; Glue, 1977a; Mikkola, 1983; Cramp, 1985; Yalden, 1985). Both species now breed scarcely, if regularly, in Wales (Lovegrove *et al.,* 1994). In an earlier report, we described the breeding ecology of a small population of Short-eared Owls on a *Calluna*-dominated moor in NE Wales (Roberts & Bowman, 1986). These birds were unusual for the large proportion of Pygmy Shrews *Sorex minimus* and *Apodemus* mice in their diets, a proportion that we attributed to the apparent predominance of these mammals in heather moor. This owl population - still under study - has now declined in numbers and since 1984 breeding has taken place only twice to our knowledge. From 1991 we have studied the food of Long-eared Owls in a single territory on the fringe of the same moor. In this paper we present the results of this work, comparing the diets of the 2 owl species.

METHODS

Study area

The Long-eared Owls roosted (and in at least 2 years bred) in conifers lying between *Calluna*-dominated, dry moorland and upland pasture converted from heather moor at least

30 years earlier, and grazed by horses, sheep and cattle. The conifers, chiefly Scots Pine *Pinus sylvestris* and larch *Larix,* grew both in the pasture and, as self-setters (and generally more openly), on ground dominated by Ling *Calluna vulgaris* or Bilberry *Vaccinium myrtillus.* These tree are also spreading into the more open moorland.

No Short-eared Owls were seen within 2km of these conifers, but Tawny Owls *Strix aluco* bred in at least 2 years (and probably annually) in an adjacent wood, occasionally calling from close to the Long-eared Owls' favourite roost points.

No attempt was made to census the owls' potential prey but, in addition to mammal species found regularly in pellets, Grey Squirrels *Sciurus carolinensis* were common in wooded parts and Mole *Talpa europea* hills were numerous on the grassland. Hares *Lepus capensis* were seen in wood, moor and pasture, but Rabbits *Oryctolagus cuniculus* were uncommon generally. In winter months and up to mid-April flocks of Fieldfares *Turdus pilaris* and Redwings *T. iliacus* roosted in the wood. Otherwise small passerines characteristic of upland conifer woods and heather moor were present in numbers believed to be typical for these habitats.

The Short-eared Owls occurred on predominantly dry *Calluna*-dominated moorland, with some wet hollows and considerable encroachment of Bracken *Pteridium aquilinum.* The moor, grazed by sheep, is managed for Red Grouse *Lagopus l. scoticus,* though shooting ceased after 1992 to conserve stocks. One long boundary of the moor is formed by agricultural land, another by a large stand of conifers planted in 1971-1972. Since our earlier work (Roberts & Bowman, 1986), the amount of short vegetation cover on the moor has decreased markedly, the result of mass grow-back after a big fire in 1980.

Methods

Diet of both species of owls was investigated through analysis of pellets collected randomly at winter and breeding season roosts and at (and near) nests. Prey proportions in the owls' diets have been calculated by both number and weight. We have followed Southern's (1956) estimates of weight of prey species, for consistency with our earlier paper (Roberts & Bowman, 1986), although Yalden's (1985) estimates are now regarded as more accurate. (Neither percentages nor order of importance of species are importantly altered by applying Yalden's weights to our data, except with birds, where the lack of precise identification anyway reduces precision.) Bird prey was quantified and, where possible, identified from mandibles, humeri, tarsi and synsacrum, the highest count of one of these being taken as the minimum number of individuals. Beetle remains were uncommon in pellets and are not included in tables or discussion. For nomenclature and order of mammals we follow Corbet & Southern (1977).

For consistency with earlier studies (*eg* Glue & Hammond, 1974; Yalden, 1985), we have taken March 1st and July 31st as the limits of the breeding season for Long-eared Owls. Prey collections made 5 or fewer days after these dates are allocated to the prior period. One major collection of 172 prey items, made on March 18, is divided evenly between winter and spring. We have also, however, because prey taken before and after mid-April appeared to differ, analysed separately for April 16th to July 31st and before and after this period.

For Short-eared Owls, which breed later in our study area (*unpubl. data*), we have allocated prey samples from March to the winter diet category. Our sample of breeding season diet since 1984 comprises 241 vertebrate prey items, out of which 136 are from years of breeding, 16 from a year of apparent non-breeding and a further 89 from a year in which breeding may have taken place. The sample does not, therefore, permit meaningful comparison of breeding season diet in years of breeding and of non-breeding.

RESULTS

Status of Long-eared Owls and Short-eared Owls in the study area, 1985-1999

Short-eared Owls bred only irregularly on the study moor after 1984, as did Long-eared Owls in the territory, first found in 1990, where we have since studied their diet (Table 1). Long-eared Owls bred in this territory in 2 (possibly 3) years out of 10, though successful breeding took place elsewhere on the fringe of the moor in 1991 (I. Williams, *pers. comm.*), in 1999 and in two other years (the late L. Hayward and M. Griffiths, both *pers. comm.*). In at least 3 of the cases outside our main study territory, no breeding took place in the following year.

Table 1. The status of Long-eared and Short-eared Owls in a NE Wales moorland study area during 1985-1999. The presence of Long-eared Owls was not detected until 1990.

	1985	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*
Long-eared Owl						B	(B)B?	DP
Short-eared Owl	(a)	X	W	WPD(a)	WB?m	B	W(a)	X
	1993	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	
Long-eared Owl	B	DP	DP	D	(m)	P(á)	(m)	
Short-eared Owl	B	W	D(a)	X	(a)	(j)	?(a)D?	

Notes: B breeding; (B) breeding away from study territory; P pair; D display calling; W winter only; (a), (m), (j) one bird present until April, May or June but not breeding; X none located; ? record uncertain.

In the only 2 cases of breeding where nest histories were followed through by us, one at our study territory and one on a different edge of the moor, 5 eggs were laid and 3 and 2 young raised respectively, one chick at the second site dying (probably from cold) after falling from the nest.

In the study territory, one or 2 Long-eared Owls were present every winter, apparently arriving in November, as searches in September and October found no evidence of presence. Apart from in the years of proved breeding, birds - mostly pairs - were present beyond the middle of April in 5 years, in 3 of which pairs were heard displaying, in one of these only the female. After 1997 we heard and saw no courtship display in the territory, and in 1997 and 1999 all evidence of the owls' presence ceased after late March (though, in 1999, at least one owl had returned to the territory by July).

For Short-eared Owls, in the 15 years since our earlier study (Roberts & Bowman, 1986), breeding has been known to occur twice and suspected once. In 3 years there were no sightings, in 2 years winter records only and in 6, possibly 7, years birds were present into the breeding season, 2 of these cases involving pairs, the rest single birds, and in 3 years we have heard display calling. Once birds stayed only into March, 5 times into April and once into June, the last case an apparently unmated but nevertheless alarm-calling bird that may have lost eggs during heavy snow in mid-April. The only years of proved breeding, 1990 and 1993, were also the only known years of breeding by Long-eared Owls in our main study territory.

Diet of Long-eared Owls

As shown in Table 2, remains of at least 1609 vertebrate prey items of Long-eared Owls were collected between 1991 and 1999. There were major differences between years in proportions of different prey species, but Wood Mouse *Apodemus sylvaticus* (or Yellow-necked Mouse *Apodemus flavicollis* - see footnote to Table 2) predominated numerically, with Pygmy Shrew next in importance, and Field Vole *Microtus agrestis,* Bank Vole

Clethrionomys glareolus and birds also numerous. The Common Shrew *Sorex araneus* was notably infrequent in the diet. As shown in Table 3, Wood Mouse dominated the diet in biomass in 5 years, with Field Vole, Pygmy Shrew and Bank Vole dominant, respectively, in 2, one and one year. The importance of Pygmy Shrews by biomass declined after 1993, but this may have resulted at least in part from the reduction, in those years, of prey samples from after mid-April - after which date voles and mice occurred much less frequently in the owls' diet. Thus, in 1991, the year of maximum Pygmy Shrew biomass in the diet, no collections of pellets were made until May 7th, while in 1999, when 52% (by weight) of all prey was collected in July, this Shrew's importance increased again.

Table 2. Yearly totals of vertebrate remains in pellets of Long-eared Owls on a NE Wales moor 1991-1999. Prey collections from November-December are included in the following year's sample.

	Number of Individuals										
	1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*Total*	*%*
Mole *Talpa europaea*									1	1	0.1
Common Shrew *Sorex aranus*	1		10	1	1		2		7	22	1.4
Pygmy Shrew *S. minutus*	72	18	133	34	47	27	25	19	14	389	24.2
Natterer's Bat *Selysius nattereri*						1			1	2	0.1
Long-eared Bat *Plecotus auritus*		1		1						2	0.1
Squirrel *Sciurus sp.*	1									1	0.1
Bank Vole *Clethrionomys glareolus*	4	8	45	19	50	47	34	32	6	245	15.2
Field Vole *Microtus agrestis*	1	3	31	9	120	37	28	25	20	274	17.0
Apodemus species	13	59	119	42	40	41	79	85	11	489	30.4
Bird species	5	18	28	41	29	11	16	30	6	184	11.4
Total	**97**	**107**	**366**	**147**	**287**	**164**	**184**	**191**	**66**	**1609**	

Notes: Both Wood Mouse *Apodemus sylvaticus* and Yellow-necked Mouse *A. flavicollis* may occur in the area but no attempt was made to separate them. Birds were pipits *Anthus* 65, pipit-sized 61, smaller than pipit 12, Wren *Troglodytes troglodytes* 4, Fieldfare *Turdus pilaris* 1, Mistle Thrush *T. viscivorus* 2, thrushes *Turdus* 10, thrush-sized 24, finches *Fringillidae* 3.

Table 3. Yearly biomass of vertebrate remains in pellets of Long-eared Owls on a NE Wales moor during 1991-1999. A conversion factor in 'prey units' has been applied to each item, based on the estimated weight of the species, see Southern (1954).

	% prey weight									*Conversion*	*Overall %prey*
	1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*factor*	*weight*
Mole									9.1	5.0	0.39
Common Shrew	1.17		1.9	0.4	0.2		0.6		6.4	0.5	0.85
Pygmy Shrew	33.6	3.9	10.3	5.7	3.8	3.8	3.1	2.2	5.1	0.2	6.02
Natterer's Bat						0.3			0.7	0.4	0.06
Long-eared Bat		0.4		0.3						0.7	0.11
Squirrel sp.	11.7									5.0	0.39
Bank Vole	9.3	8.7	17.0	16.0	20.1	33.2	20.9	18.2	11.0	1.0	18.95
Field Vole	2.3	3.3	12.0	7.6	48.2	26.0	17.2	14.2	36.6	1.0	21.19
Apodemus sp	30.3	64.2	47.6	35.4	16.7	28.9	48.5	48.4	20.1	1.0	37.82
Birds	11.7	20.0	10.8	34.6	11.7	7.8	9.8	17.1	11.0	1.0	14.23
Sample (prey units)	**42.9**	**91.95**	**258.6**	**119**	**248.9**	**142**	**163**	**175.8**	**54.7**		
Approx % of sample from Mar.1-July 31st	100	58.2	43.1	100	62.4	27.5	20.0	49.9	56.5		
from Apr.16-July 31st	100	31.7	16.7	9.3	14.6	5.9	0	5.1	43.7		

Of bird prey (n=184) 68.5% were pipits *Anthus* or pipit-sized birds (believed to be pipits in the main), against 20.7% of thrushes *Turdus* or thrush-sized birds. A flock of Fieldfares and Redwings roosted within the owls' territory, both in trees and on the ground. The only year in which thrush-type remains outnumbered those of pipits was 1997, the one year in which no pellets were collected by us after late March.

Table 4 shows differences between the Long-eared Owls' diet in winter and summer, where "summer" is defined as beginning on March 1st or April 16th respectively and ending in both cases on July 31st. In this season Pygmy Shrews were 2½ time more important by weight after March 1st than before it (a difference highly statistically significant), but 4 times more important from April 16th than before this date, this proportional increase resulting from the owls' continuing to feed heavily on mice and voles up to mid-April, after which the proportion of these heavier animals in the diet fell sharply. Birds were 4 times more important by weight after March 1st than before it, but after April 16th this difference was reduced by 50%.

Table 4. Diet of Long-eared Owl on a NE Wales moor by season. In A winter is taken as July 4th to Feb. 28/29th, summer as Mar. 1st to July 3rd. A large prey collection made on Mar. 18th has been equally divided between winter and summer. There were significant differences in the proportions (weight) of some prey items seasonally - Pygmy Shrew Chi^2=24.52, df1, P<0.001, voles Chi^2=7.0,df1, P<0.01, *Apodemus* Chi^2=36.69, df1, P<0.001. In B winter is taken as Aug. 1st to Apr. 15th and summer as Apr. 16th to July 31st.

A	*WINTER*				*SUMMER*			
	TOTAL	*%*	*Prey units*	*% prey units*	*TOTAL*	*%*	*Prey units*	*% prey units*
Mole		0			1	0.11	5	0.7
Common Shrew	2	0.28	1	0.2	20	2.21	10	1.5
Pygmy Shrew	98	13.9	19.6	3.1	291	32.19	58.2	8.7
Natterer's Bat		0			2	0.22	0.8	0.1
Long-eared Bat		0			2	0.22	0.7	0.1
Squirrel sp.		0			1	0.11	5	0.7
Bank Vole	130.5	18.51	130.5	20.9	114.5	12.67	114.5	17.2
Field Vole	144.5	20.5	144.5	23.1	129.5	14.33	129.5	19.4
Apodemus sp.	290	41.13	290	46.4	199	22.01	199	29.8
Birds	40	5.67	40	6.4	144	15.93	144	21.6
Total	**705**		**625.6**		**904**		**666.7**	
B								
Mole					1	0.28	5	2.52
Common Shrew	5	0.4	2.5	0.23	17	4.84	8.5	4.28
Pygmy Shrew	201	15.98	40.2	3.67	188	53.56	37.6	18.93
Natterer's Bat					2	0.57	0.8	0.40
Long-eared Bat	1	0.08	0.7	0.06	1	0.28	0.7	0.35
Squirrel sp.					1	0.28	5	2.52
Bank Vole	225	17.89	225	20.57	20	5.70	20	10.07
Field Vole	256	20.35	256	23.40	18	5.13	18	9.06
Apodemus sp.	435	34.58	435	39.76	54	15.38	54	27.19
Birds	135	10.73	135	12.34	49	13.96	49	28.87
Total	**1258**		**1094**		**351**		**198.6**	

Diet of Short-eared Owls

Since 1985 Short-eared Owls have been known to nest only twice on the moor. Pellets were collected from these nests, from winter roosts in 2 seasons and from a summer roost of

an apparently non-breeding bird in 1998. The resulting prey sample (n=295) is considerably smaller than in our first report (Roberts & Bowman, 1986).

Since 1985 the main breeding season prey species of Short-eared Owls have been taken in the same rank order of numerical importance as in our earlier study, except that birds have overtaken Field Voles in importance, though the difference is not significant (Table 5). However, proportions (by weight) of prey species have changed considerably since the first period, with a major significant fall in Pygmy Shrews (from 14% to 6.9%), accompanied by increases in Field Voles and, particularly, in Wood Mice and birds (respectively, 15% to 19%, 18% to 29% and 14% to 21% - all statistically significant).

Table 5. The vertebrate diet of Short-eared Owls on a NE Wales moor during 1979-1998. Records for 1979 to 1984 are for the breeding season only. For 1985-1998 winter is taken as Aug. 1st-Mar. 31st, summer as Apr. 1st-July 31st. There were significant differences in proportion between 1979-1984 and summer 1985-1998 - Pygmy Shrew Chi^2 = 14.15, df 1, P<0.001; *Apodemus* Chi^2 - 18.58, df 1, P<0.001; birds Chi^2 - 9.08, df 1, P<0.01.

	1979-1984				*1985-1998* WINTER				*1985-1998* SUMMER			
	Total	*%*	*Prey units*	*%prey units*	*Total*	*%*	*Prey units*	*%prey units*	*Total*	*%*	*Prey units*	*%prey units*
Mole	2	0.3	10	2								
Common Shrew	145	20.8	72.5	17					52	21.6	26	15.4
Pygmy Shrew	298	42.8	59.6	14					58	24.1	11.6	6.9
Lagomorphs	2	0.3	40	9								
Bank Vole	47	6.8	47	11					11	4.6	11	6.5
Field Vole	64	9.2	64	15	5	10	5	9.6	32	13.3	32	19.0
Apodemus species	76	10.9	76	18	7	13	7	13.5	49	20.3	49	29.1
Birds	62	8.9	62	14	40	77	40	76.9	39	16.2	39	23.1
Total	**696**		**431.1**		**52**		**52**		**241**		**168.6**	

Notes: Birds were in winter - pipit-sized 6, wren-sized 2, thrushes 20, thrush-sized 11; in summer - Red Grouse *Lagopus l. scoticus* 1, grouse-sized 1, pipits 9, pipit-sized 21, thrushes 3, thrush-sized 3.

The small winter sample (n=52) is dominated by birds (76%), 76% of which were thrush-sized. This sample came from a valley in which large numbers of Fieldfares and Redwings roosted.

Comparison of diets of the two owl species

Generally the diets of Long-eared Owls and Short-eared Owls in our study area were rather similar. Pygmy Shrews and Wood Mice, the typical mammals of heather habitats (Corbet & Southern, 1977; Yalden, 1981), in combination dominated both diets, their proportions in the breeding season being strikingly similar (for Pygmy Shrew Chi^2=0.37, 1df, ns and for Wood Mouse Chi^2=0.0116 1df, ns). Field Voles, preferred prey in most British studies, were relatively unimportant. Birds, predominantly (presumed) moorland or moorland roosting species, were taken in similar proportions by the 2 species until the Short-eared Owls ceased to breed regularly on the moor, after which they became more important in this species' diet.

Common Shrews were much more important in our Short-eared Owls' diet (15.2% by weight) than for our Long-eared Owls (0.9% by weight), whilst Wood Mice and Bank Voles comprised a greater part of the Long-eared Owls' diet. Overall, the Long-eared Owls were less consistent in diet from year to year.

Diet of the two owl species in years of breeding and non-breeding

For Long-eared Owls, in the only prey sample that we have from a year of breeding (*ie* 1993), Pygmy Shrews already formed 4.9% of diet by weight before March and this proportion reached 9.5% by mid-April. In contrast, the average values for other years were, respectively, 2.0 (range 0.6 to 3.4, n=5) and 2.2 (range 1.3 to 3.1, n=6). In other respects prey did not differ strikingly in the year of breeding from that in other years.

Because of the nature of our sample (see Methods), the diet of our Short-eared Owls in years of breeding and non-breeding cannot meaningfully be compared within the period of the present study. However, Common Shrews and birds were much more important in 1990 than in 1993, 17.18% and 19.64% respectively *cf* 5.43% and 4.35% and Field Vole and Bank Vole were much more important in 1993 than in 1990, 26.86% and 19.54% *cf* 16.37% and 4.91% (Chi^2=11.21, df 5, P<0.05).

DISCUSSION

Diet of Long-eared Owls

Our Long-eared Owls are among the few instances reported in Britain where Field Voles are not the dominant prey species (Glue & Hammond, 1974), thus supporting Cramp's (1985) postulation that *Microtus* might be taken only in proportion to its availability (relative to other small rodents) in the habitat used for hunting.

The closeness of large areas of *Calluna*-moor to the Long-eared Owls' roosting site is reflected in the large numbers of Pygmy Shrews and Wood Mice in their diet. Corbet & Southern (1977) described Wood Mice as to some extent replacing the Field Vole in heather and Pygmy Shrews have been found to outnumber Common Shrews in this habitat by about 8:5:1 in 2 studies in northern England (Butterfield *et al.,* 1983; Yalden, 1981). In our study, pipit species (35.4%) and pipit-sized birds (33.1%), probably mostly pipits, comprised the great majority of bird prey, this also pointing to moorland hunting as few if any Meadow Pipits breed on the grassland and Tree Pipits *Anthus trivialis* are not numerous in the area *(pers. obs.).* Meadow Pipits generally arrive in force on the moor in mid-March *(unpubl. data)* and the fact that thrushes (and thrush-sized birds) only outnumbered pipits in the only year when most prey derived from before March 25th points to the owls hunting the adjacent roost of wintering thrushes in the early season.

In a comparative study of owl diets in the Peak District, Yalden (1985) deduced from the numbers of Pygmy Shrews and Meadow Pipits in his Long-eared Owls' diets that these owls were hunting open moorland. There, however, Field Voles were by far the most frequently taken mammal and there was no certainty that the owls were hunting pure heather habitat (D. Yalden, *in litt.*).

In our study the relatively large numbers of Bank Voles taken may have been caught in the sizeable open woodlands on two sides of the owls' roost and possibly in areas where these trees encroach into open moor. A possibly explanation of the 50% reduction in proportion of this mammal taken after April 15th is that the Tawny Owls nesting in the open woodland become more defensive of this habitat as their chicks approach fledging, so that the Long-eared Owls are forced to hunt outside the Bank Vole's favoured habitat.

Field Voles, like Bank Voles, fell off sharply in importance in the owls' diet after mid-April. After this time the "reclaimed" grassland may have been too heavily grazed to support large numbers of this species - which may, nevertheless, have peaked in 1995 and 1999, the only years when it outweighed Wood Mice and Pygmy Shrews in the owls' diet. Such a peak could have drawn the owls away from hunting moorland.

Considering the abundance of Mole hills and thus, presumably, of earthworms on the grassland area, the small number of Common Shrews taken by the Long-eared Owls is

interesting: Yalden (1981) described earthworms as a favourite prey of the Common Shrew. Interestingly, in 1993 and 1999, when this shrew was most numerous in our owls' prey, it occurred most in July collections. In 1999 the Long-eared Owls found breeding on a different edge of the study moor were also feeding more freely on Common Shrews, which comprised 51% of prey remains (n=32.3 "prey units" by weight) in collections from May 25th to June 6th. In 1999, Field Voles were more important than in any other year except 1995 (when most of the prey sample derived from prior to April 16th), arguing for greater concentration of feeding by the owls in grassland habitats.

After mid-April Pygmy Shrews dominate our owls' diet even by weight, in contrast with Yalden's (1985) results from the Peak District, where in a relatively small winter season sample (n=99), this shrew was more important than in the breeding season. There, however, as in our study, Wood Mice and Field Voles were more important in winter, though the difference was much less marked than in our study. Also as in our study, birds were more important in the breeding season than in winter.

Comparison of diets of the two owls

Generally the remarkable similarity in the diets of the Long-eared and Short-eared Owls in our study area, with typical heather mammals, Pygmy Shrews and Wood Mice (Corbet & Southern, 1977; Yalden, 1981), predominating numerically, presumably reflects the owls' shared moorland habitat. That Field Voles were of markedly less importance corresponds with their general uncommonness in heather moor, as described by Corbet & Southern (1977).

The much greater importance of Common Shrews in our Short-eared Owls' diet is puzzling, particularly as there seemed to be few worm-rich areas within the moor's boundary, but plenty within the potential hunting territory of the Long-eared Owls. The greater contribution of Wood Mice and Bank Voles to the Long-eared Owls' diet presumably stems from the more wooded nature of the ground surrounding their roost. Predictably, with a wider choice of habitats to hunt in and the likelihood of some prey species within these varying in number between years, the Long-eared Owls were less consistent in diet from year to year.

Status of Long-eared Owls

The failure of the Long-eared Owls to breed in most years since 1990 is puzzling. The Carrion Crow's *Corvus corone corone* nest used for breeding by the owls in 1993 was hollowed out in 1991 and contained an owl's body feather. The owl pair was present nearby, as they were in 1992. From 1994 there were 2 crows' nests in good condition within 30m of the now degraded original nest. Close to the roosting wood there is ample deep heather. There is thus no apparent shortage of suitable nesting sites.

The situation from 1990 to 1993 argues against infertility in either of the owls - assuming that the same individuals are involved each year. The 2 nests seen by us - in 1993 and, in the site on a different edge of the moor, in 1999 - both contained 5 eggs, a clutch size above the mean of 4.15 given by Glue (1977b) for a sample of 87 British nests and suggestive of an ample food supply. Again, the occurrence of display in most years and the owls' presence into June or July suggest that the territory is not a "staging post" on the way to a breeding site elsewhere.

Shortage of (suitable) food seems a more probable cause of failure to breed. The absence of sightings between late July and the late October suggests that the birds move away in this period, but then return in November to a food supply adequate to support a pair of adults. There is a possibility that this supply only occasionally becomes sufficient to trigger egg laying. In 1993, the main study territory's only year of breeding from which we

have prey samples, the proportion of Pygmy Shrews in the diet from March onwards was much higher than in other years. As this is the only major detected difference in diet between years of non-breeding and of breeding, and as the proportion of heavier mammal prey drops sharply by mid-April, it could be that breeding is only possible in years of exceptional abundance of the much smaller Pygmy Shrew.

Status of Short-eared Owls

The irregular and much reduced presence of Short-eared Owls on the moor after 1984 is difficult to explain. The marked apparent change in diet since the first period of study, with a major decrease in Pygmy Shrews and considerable increases in Wood Mice and birds, may indicate a change in the moor's available food spectrum. As considered possible for Long-eared Owls, the food available in most years may be insufficient to support breeding, an idea supported by the presence and, sometimes, display of pairs or single birds in the early breeding season, followed by failure to breed (or attract a mate). This is believed to be the reason behind fluctuating breeding numbers on Berwyn and Skomer (I. Williams, *pers. comm.*). Unfortunately, conclusive comparison of summer diets from years of breeding and of non-breeding is obviated by the smallness of our sample from the latter category of year, by uncertainty over whether breeding took place in 1998 and by the major differences in diet in 1990 and 1993, the 2 years of breeding in which food samples were obtained.

With nearly 20 years of re-growth of heather since the large fire of 1980 destroyed 2 out of 4 regular nesting sites, lack of suitable breeding habitat is unlikely now to be a factor.

Another and more probable explanation of the facts is the general scarcity of this owl in Wales in the breeding season in recent years (Lovegrove *et al.,* 1994) and its recent decline in numbers (I. Williams, *in litt.*), partly a consequence of reduction in availability of recently enclosed and afforested upland grazing. This interpretation is supported by the species' absence from our moor in some years and the current tendency towards presence of single birds only in the breeding season. If *Calluna*-moor is sub-optimal or "sink" breeding habitat for the species, very low levels of occupation and sporadic breeding might be expected in periods of nationally low population.

The situation of the Short-eared Owl is part of a wider pattern of decline, on our study area and - in most cases - in Wales generally, involving medium sized moorland birds as diverse in ecological requirements as waders (Golden Plovers, Lapwings and Curlews), Merlins and Red and Black Grouse (*eg.* Lovegrove *et al.,* 1994; I. Williams, *in litt.;* Roberts, 1998; Roberts & Jones, 1999). Understanding the causes of these declines is vital to the conservation of this rich and globally restricted habitat.

ACKNOWLEDGEMENTS

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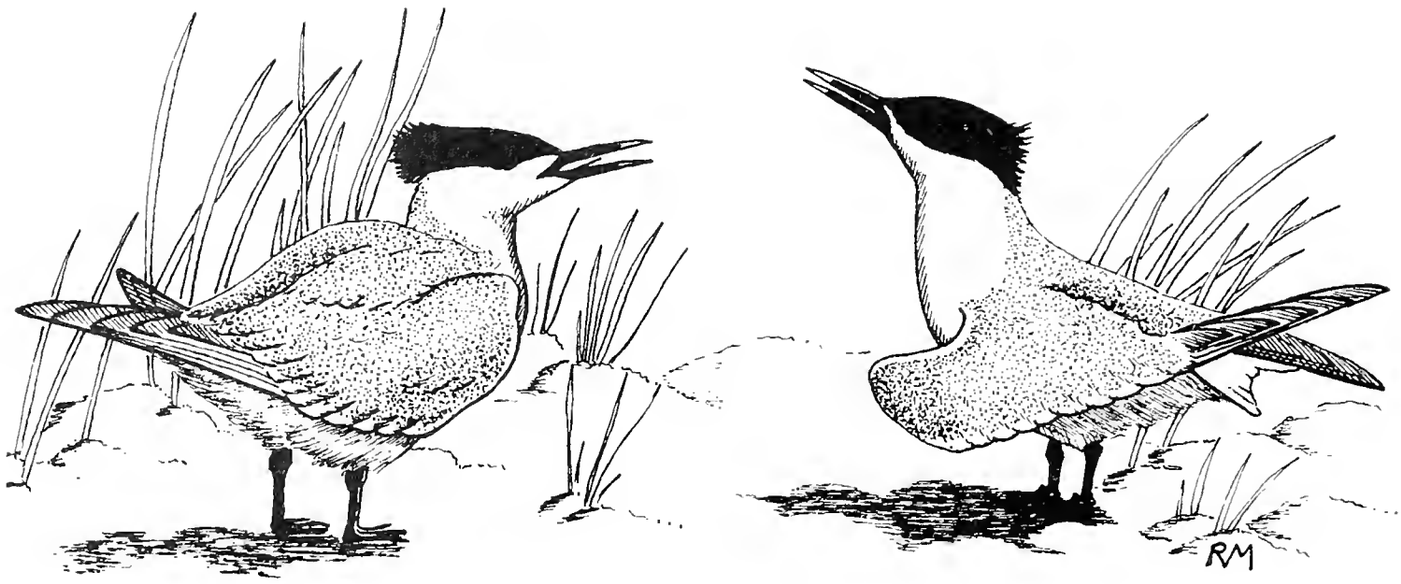

BREEDING TERNS IN WALES, 1975-1999

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INTRODUCTION

1999 marked the 25th anniversary of the inauguration of the comprehensive annual monitoring of breeding tern numbers in Wales. The task has become, sadly, easier to carry out in recent years as the number of breeding colonies has declined and whilst there is good news in that the total of breeding pairs has shown a steady increase (Figure 1) there is cause for great concern in the near demise of the once flourishing population of Roseate Terns.

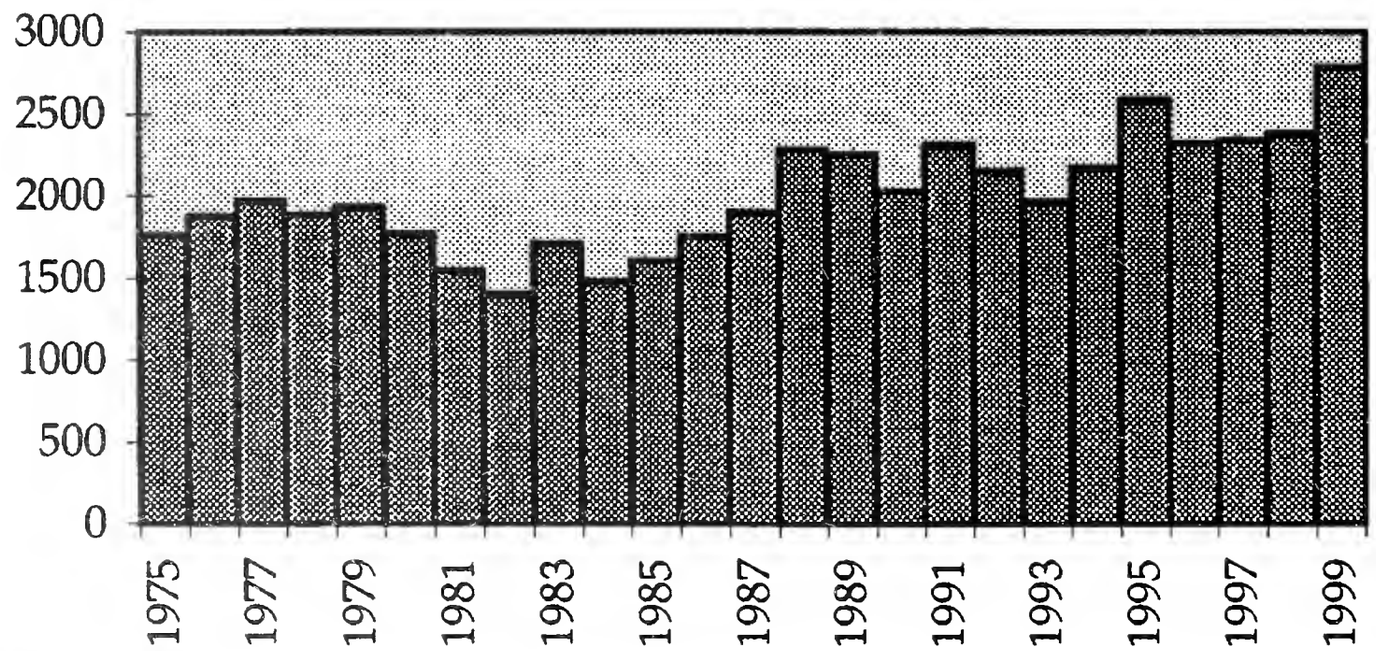

FIGURE 1: Number of pairs of all tern species breeding in Wales during 1975-1999.

The period has also been characterised by shifts of some populations within Wales, a feature which is long established and widely recorded, for reasons which are not always apparent. Considerable resources have been dedicated to the protection of the main colonies

during the past 25 years, involving wardening and habitat-management, notably by the RSPB, North Wales Wildlife Trust (NWWT), Countryside Council for Wales (CCW) (formerly Nature Conservancy Council), Welsh Water, Clwyd Ornithological Society and the Merseyside Ringing Group.

During the review period Anglesey remained the chief stronghold for breeding terns in Wales, as was the case throughout the 20th century, but colonies were also recorded from the mouth of the Dysynni near Tywyn as far round as the estuary of the Dee. There follows a species by species account.

SPECIES ACCOUNTS

Sandwich Tern Sterna sandvicensis

Figure 2 shows the annual population recorded for 1975 to 1999. In Wales Sandwich Terns have only featured as a regular breeding species comparatively recently, since 1970, and have been confined to 3 sites on the north and west coast of Anglesey. By far the greatest concentration in recent years has been at the NWWT reserve at Cemlyn Bay which peaked at 1080 pairs in 1988 and 830 pairs in 1989. Since that time numbers have stabilised at 400 to 650 pairs and with reasonable numbers of young fledged annually the future of this colony should be assured. A new flood barrier in 1978 has proved effective in preventing the tidal inundations which had caused damage in some previous years.

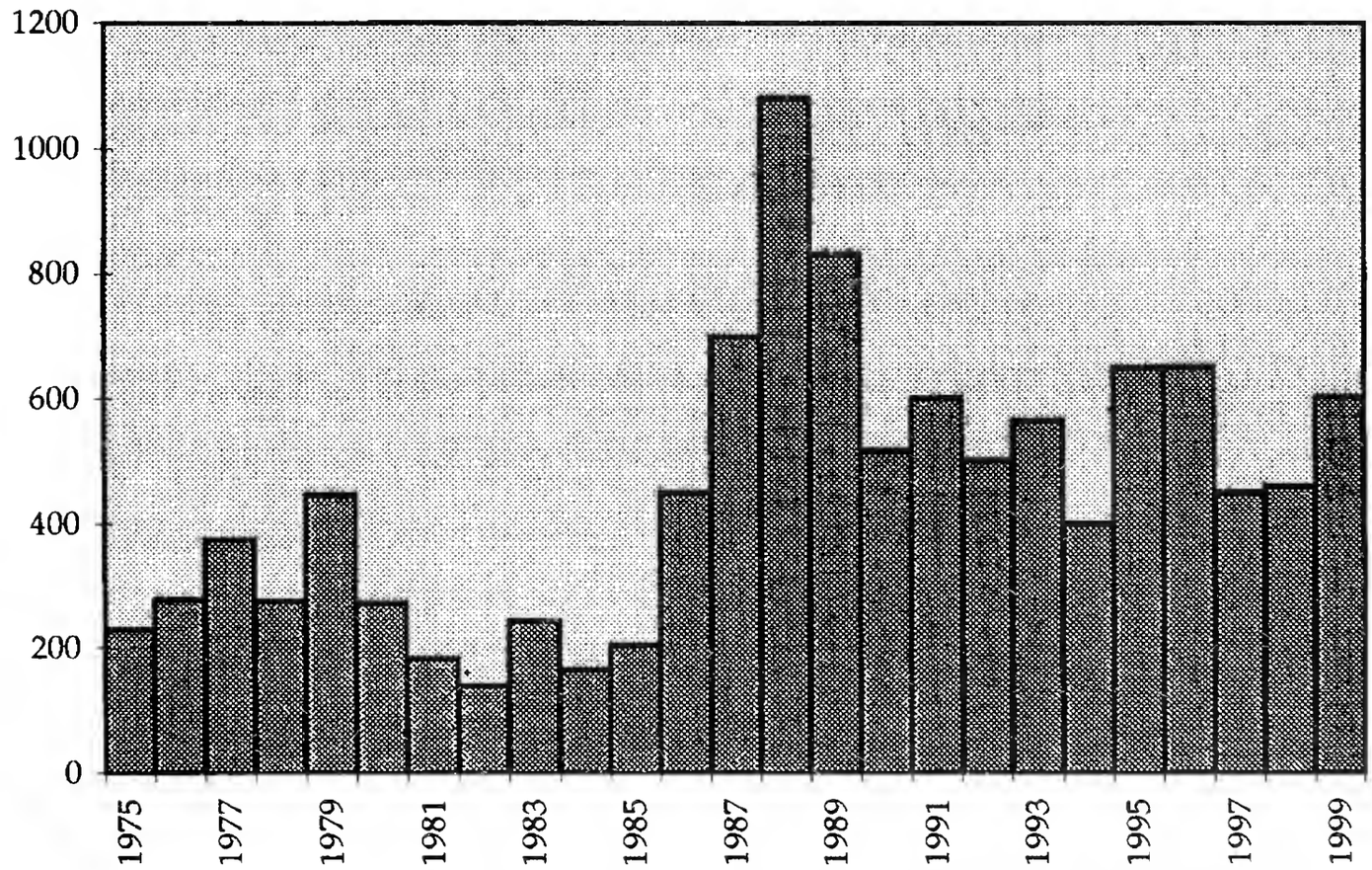

FIGURE 2: Number of pairs of Sandwich Terns breeding in Wales during 1975-1999.

Roseate Tern S. dougallii

Figure 3 shows the annual population recorded for 1975 to 1999. From being the stronghold for this species in Britain and Ireland during the late 19th and early 20th centuries it is very disappointing to record that Roseate Terns are now struggling to remain on the Welsh list of breeding birds; indeed the population dropped to one pair in 1996!

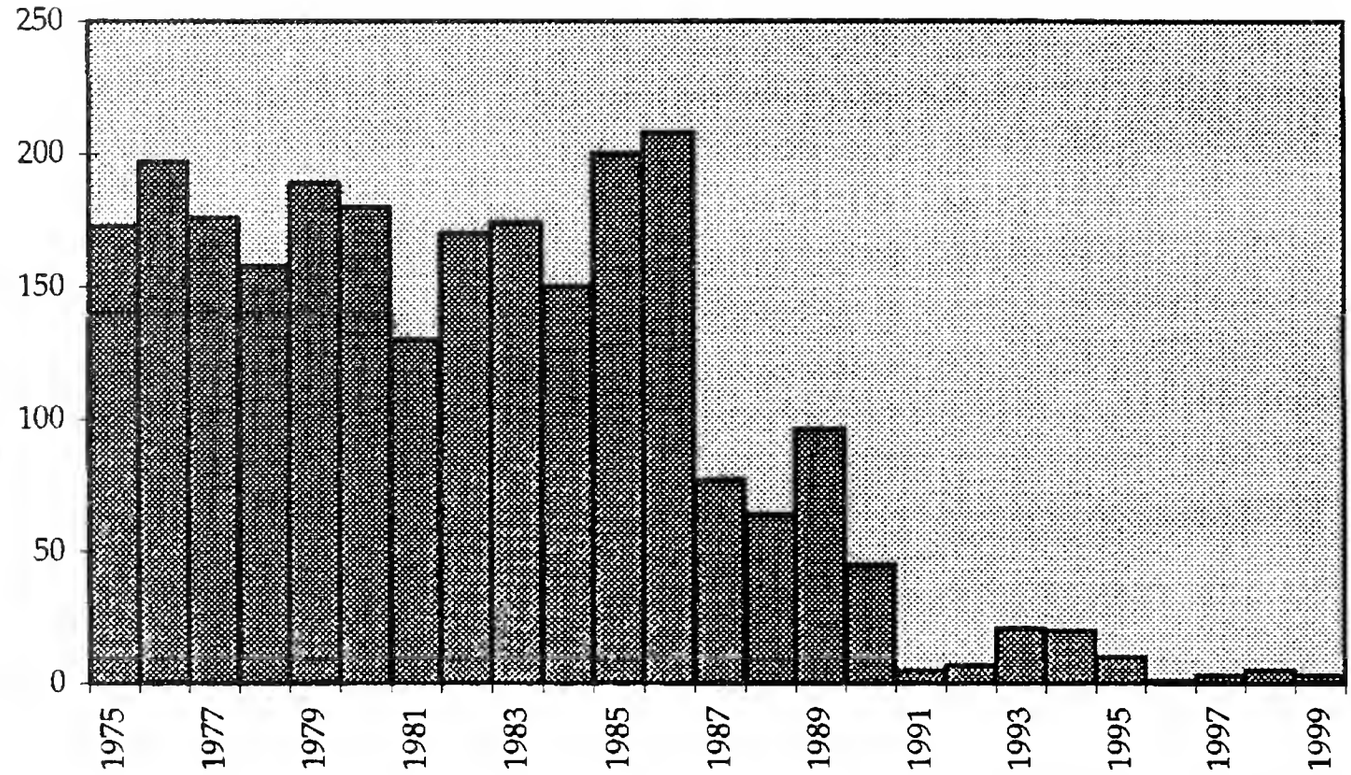

FIGURE 3: Number of pairs of Roseate Terns breeding in Wales during 1975-1999.

During the review period the recorded nesting sites have all been in Anglesey, principally on Ynys Feurig, an RSPB reserve since 1975. At that colony predation caused notable problems in productivity in some years, through loss of eggs or young to a variety of predators, including rats, gulls, and from 1980 Peregrines *Falco Peregrinus*. In 1987 a Fox *Vulpes vulpes* got onto the breeding site in late May and killed at least 52 roosting adult terns, including 12 Roseates; this was the year that numbers slumped at the site, from 200 pairs in 1986 to 40 pairs in 1987. The sole consolation from this gloomy situation was that a substantial number of the Anglesey population was shown at that time, through ringing, to have supplemented the breeding colony at Rockabill on the east coast of Ireland.

On an optimistic note the Rockabill population continues to increase and flourish (611 pairs in 1999) and in that situation there is every likelihood that at some time in the not too distant future Roseates will start to re-colonise traditional sites on this side of the Irish Sea. With that in mind wardening efforts are being maintained on Anglesey to retain suitable conditions for them.

Common Tern S. hirundo

Figure 4 shows the annual population recorded for 1975 to 1999. In some years Common Terns were not differentiated from Arctic Terns at some sites and therefore the totals are excluded for those years in Figure 4.

In the first 5 years of the counts 7 breeding sites were recorded, all but one (the Dee) on Anglesey. The 2 largest colonies were on the islet of Ynys Gorad Goch in the Menai Straits and at Shotton Pools, within the British Steel works, where rafts constructed by the Merseyside Ringing Group (MRG) attracted the birds which formerly nested on the Dee saltings where they were often subject to tidal inundation. One of the colonies was inland at the relatively new reservoir at Llyn Alaw: this was active in most years from 1976 to 1992, peaking at 100 pairs in 1983 when presumably breeding conditions on the islands in the reservoir were at their optimum.

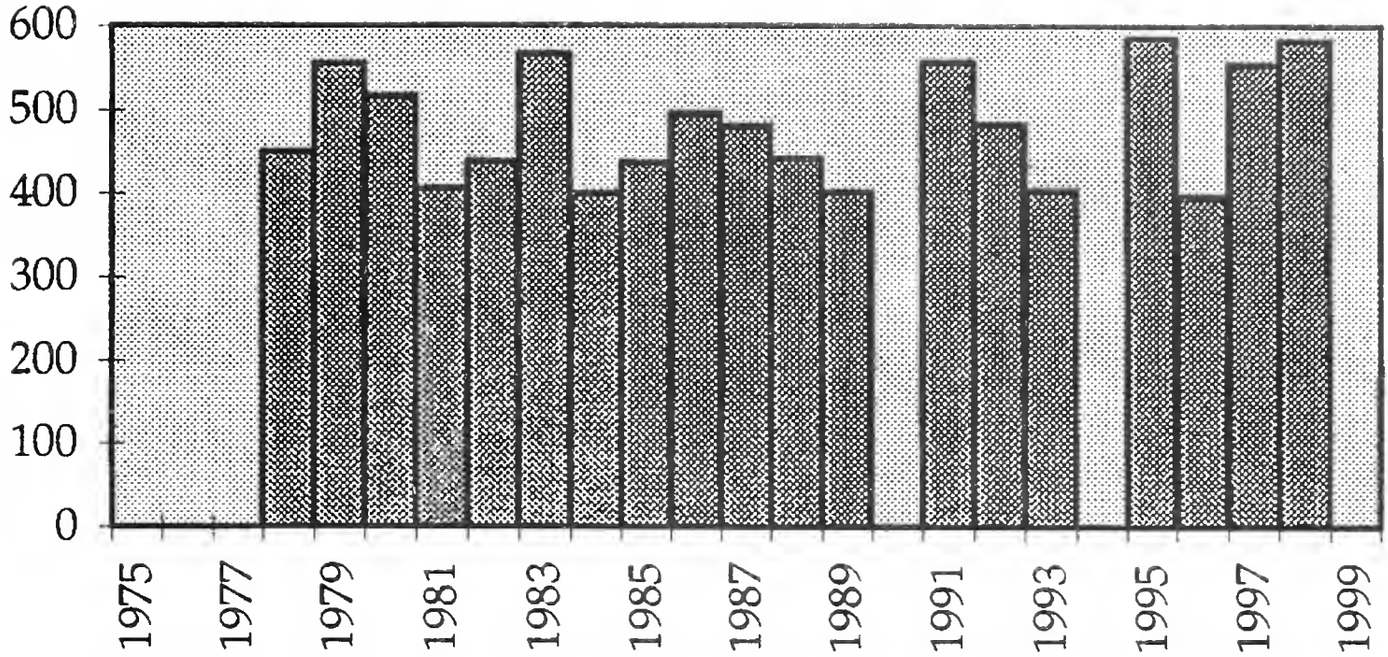

FIGURE 4: Number of pairs of Common Terns breeding in Wales during 1975-1999.

Since these early years the Shotton colony has gone from strength to strength under the aegis of the MRG and with the active support of British Steel Shotton whose logo is a Common Tern in flight! Enhanced breeding sites have been created by turning bunds into islands, and from a figure of 127 pairs in 1975 the colony had increased to 433 pairs by 1999, at which level it was by far the largest recorded in Wales during the review period. Whilst, as ever with terns, breeding success in some years has been decidedly poor, several thousand young have fledged from Shotton and it is encouraging that the future of this important site appears to be assured.

Disappointingly, however, the long established colony of Ynys Gorad Goch was deserted in 1999 following a complete failure in 1998 early in the incubation period. The reasons for this are unclear but it is hoped that this traditional site may be re-colonised in the future.

Arctic Tern S. paradisaea

Figure 5 shows the annual population recorded for 1975 to 1999. In some years

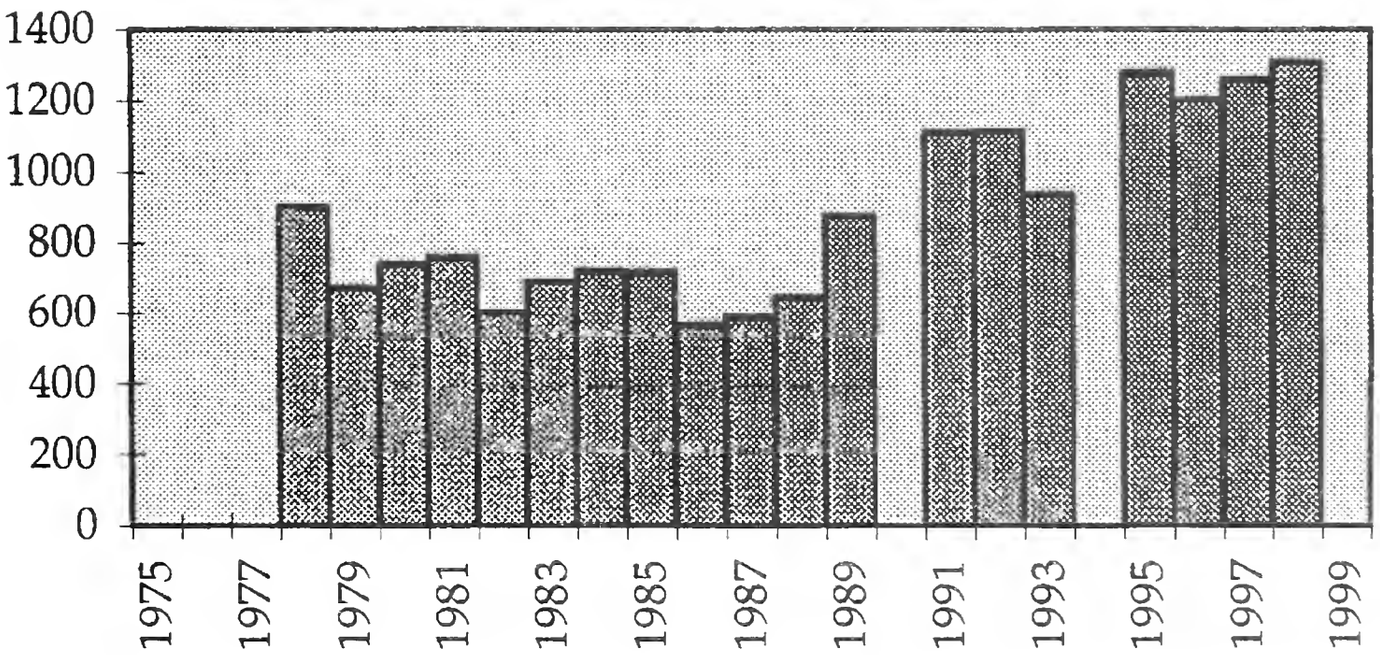

FIGURE 5: Number of pairs of Arctic Terns breeding in Wales during 1975-1999.

Common and Arctic Terns were not differentiated at some sites; Figure 6 shows the total for both species.

In all years but two (1987, 1988) this species was the most abundant breeding tern in Wales. All breeding colonies were on Anglesey and in the mid to late 1970's 9 sites were recorded, some of which were of small size, up to 12 pairs, on headlands and islets off the west coast (eg at Ravenspoint Road, Trearddur Bay, which was subject to substantial human disturbance).

During this early period the largest colony was on the Inland Sea, the strait between Holy Island and the main part of Anglesey. Unfortunately the very close proximity of a refuse tip resulted in severe predation by rats, gulls, cats, foxes and crows and by the time the tip was closed in 1977 the mixed colony of terns had dwindled considerably. From the increase in numbers there it appears that the bulk of the terns had moved to the NWWT Reserve at Cemlyn Bay, some 15km away; however some Arctic Terns did remain on the Inland Sea until 1983 and they re-colonised from 1989 onwards.

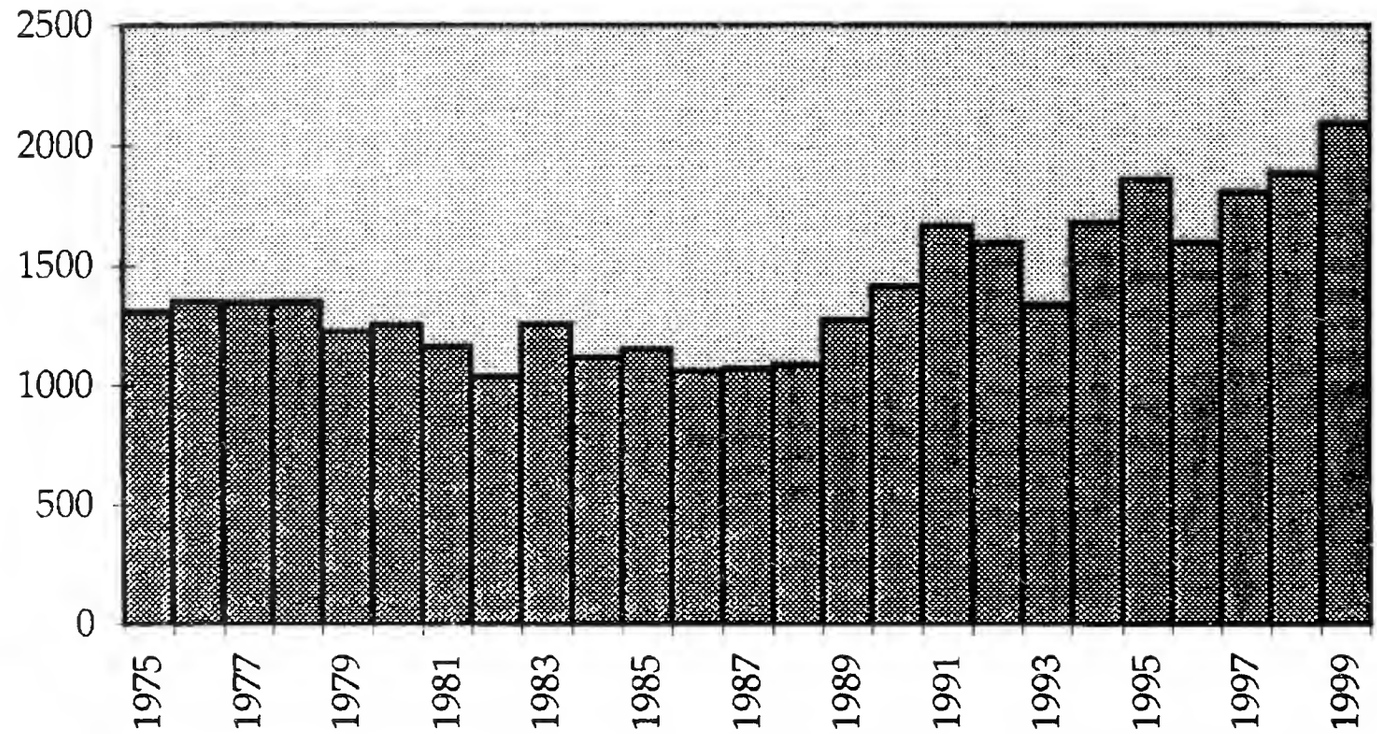

FIGURE 6: Number of pairs of Common and Arctic Terns combined breeding in Wales during 1975-1999.

In 1979 the lighthouse keepers reported the re-colonisation of the Skerries; this group of islets had historically been the stronghold for Arctic Terns in Wales, with over 1000 pairs in the early years of the 20th century but the colony was deserted from 1961 when it was noted that rats and gulls were causing problems. Wardened as an RSPB reserve by agreement with Trinity House since 1983, it is pleasing to note that the build up of numbers has continued, topping 1000 pairs again in 1995 and each subsequent year. The colony had reached 1122 pairs by 1999 and with notably high fledging success in recent years it is hoped that under the aegis of resident wardens numbers will continue to increase. Probably related, in part at least, to the build up on the Skerries the population at Cemlyn Bay, only 7km away, has dwindled from a peak of over 600 pairs in 1977 to only 4 pairs in 1999.

Little Tern S. albifrons

Figure 7 shows the annual population recorded for 1975 to 1999. In 1975 this was the most widely distributed tern species, albeit with the lowest total population. At that time there were 4 colonies which totalled 48 pairs: Aber Dysynni (Meirionnydd), Criccieth

(Caernarfon), Abermenai Point (Anglesey) and Gronant (Flint). These were surviving sites from a much wider distribution in the previous 30 years and, sadly, this trend has continued up to the present, to the extent that the only colony from 1989 to 1999 has been the one at Gronant, on a shingle ridge close to the mouth of the Dee estuary.

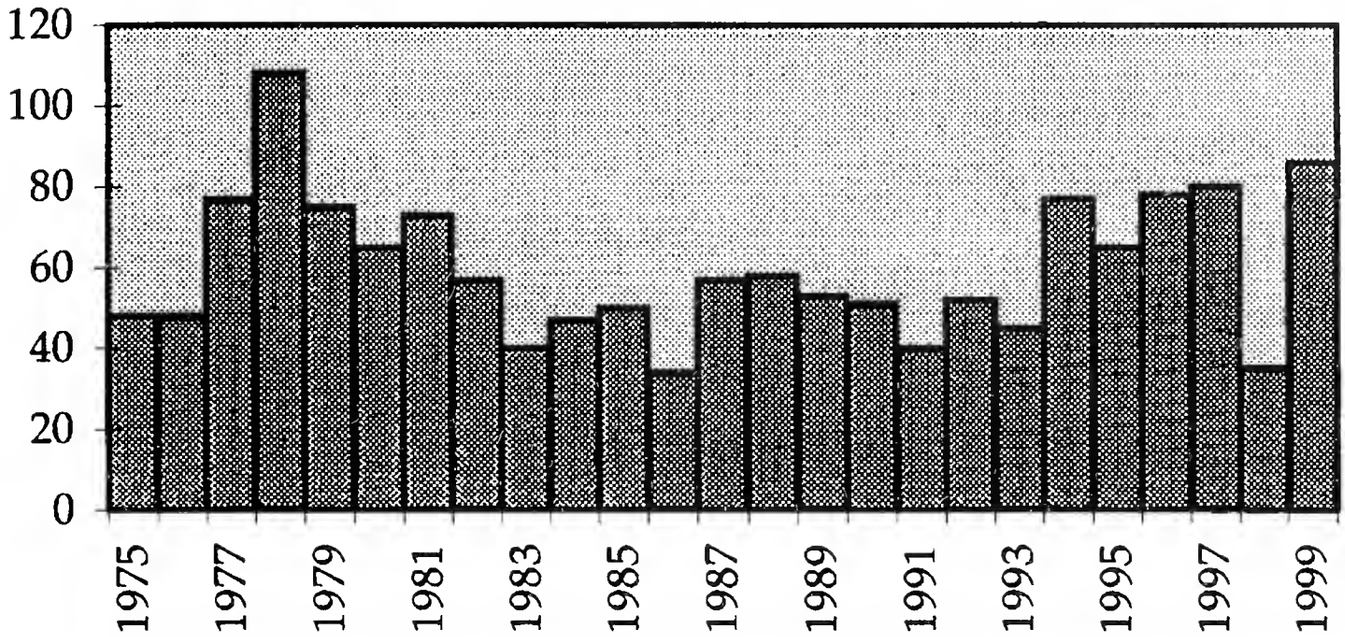

FIGURE 7: Number of pairs of Little Terns breeding in Wales during 1975-1999.

Fortunately the Gronant colony, in spite of the usual vicissitudes facing Little Terns through their choice of nest site (eg tidal flooding, sandstorms) and predation by foxes and crows, has proved to be very productive in many years. In the years from 1992-1999 at least 560 young have fledged and by 1999 the colony numbered 86 pairs, the second highest figure in the period under review.

Intensive round the clock wardening by the RSPB, grant aided by CCW and with the help of volunteers, has ensured the survival of this one remaining stronghold. There are, however, potential threats in the offing in the form of proposed offshore developments which could reduce the supply of fine sand and shingle required to maintain the breeding site in suitable condition. These proposals are being rigorously scrutinised and assessed to ensure the future of the colony.

ACKNOWLEDGEMENTS

This summary would not have been possible without the enthusiastic support and dedication of many individuals who acted as wardens, both paid and voluntary, and devoted much time to monitoring and protecting the colonies of these most elegant of birds. It is impossible to mention them all by name but very grateful thanks are due to them and also to the bodies referred to in the Introduction who have dedicated substantial resources to this very worthwhile cause.

THE PAST AND PRESENT STATUS OF THE PEREGRINE FALCON *Falco peregrinus* in Breconshire (*vc.* 42)

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SUMMARY

The past status of the Peregrine in Breconshire was reassessed using a combination of documented records and the registration years of racing pigeon rings recovered at breeding sites. The results show an increase from one breeding territory at the turn of the century to nine in the 1930's. This increase was probably associated with the development of pigeon racing in South Wales and a decline in persecution by gamekeepers. There is evidence of a slight population decline associated with the two World Wars, probably as a result of a shortage of available racing pigeons. Organochlorine pesticide poisoning resulted in the local extinction of the Peregrine in Breconshire, the main decline occurring from 1958 with the last breeding pair recorded in 1962. The first pair to breed in the county following the pesticide ban nested in 1976 with a second pair becoming established in 1978. Thereafter the population steadily increased to fluctuate around 20 pairs since 1992, reaching a peak of 22 breeding pairs in 1996. Our study has indicated that there has been an increase in the number of pairs which have failed to breed in established territories in recent years and that this is most noticeable in the north of the county. A survey in 1999 revealed 21 pairs breeding in Breconshire. We suggest that the Peregrine population in the vice-county is currently limited by the availability of their principal prey i.e., racing pigeons. Breeding success in the county is similar to that found in Britain as a whole but it is important that the species' breeding ecology continues to be monitored.

INTRODUCTION

The history of the breeding Peregrine *Falco peregrinus* population in Britain during the last century is one of widely contrasting fortunes. Ratcliffe (1980; 1993) summarised the population trends during the 20th century and suggested that numbers were fairly stable within Britain as whole for the period 1900 to 1940, though information for several geographical regions was rather sparse. During World War II direct persecution under the Destruction of Peregrines Falcons Order of 1940, which expired in February 1946, meant that numbers fell to about 87% of the 1939 level nationally. The impact of this persecution, designed to protect military carrier pigeons, varied from region to region but Peregrines in Breconshire were relatively free. As Peregrines nationally were recovering from the war-time decline the population was severely depleted by the effect of organochlorine pesticide contamination, the symptoms of which began to appear in 1956. The crash was dramatic and continued until around 1964, after which the population bottomed out at around 40% of the pre-war level and eventually begun to slowly recover by the end of the decade. The rate of decline, the timing of the population crash and subsequent recovery varied from region to region within Britain. Since that time, decadal surveys in 1971, 1981 and 1991 have charted the recovery and increase in Peregrine numbers throughout Britain and the most recent population estimate stands at around 1200 pairs (Crick & Ratcliffe, 1994). The population trends in Wales over the last century broadly mirror that outlined by Ratcliffe for Britain as a whole, and there were 280 occupied territories identified in 1991 (Williams, 1992; Lovegrove *et al.*, 1994).

In this paper we aim to reassess the historical status of the Peregrine in Breconshire during the 20th century and document the current distribution and abundance of breeding Peregrines within the county. The breeding success of Peregrines in the county is assessed and potential factors which might influence the breeding Peregrine population in the future are discussed.

METHODS

To assess the population trends throughout the 20th century we have adopted two approaches. Firstly, we have collated documentary evidence from published material and the personal records of individuals who have taken an interest in breeding Peregrines in the county. The unpublished material generously made available to us include old diaries, data cards from egg collections held in museums and detailed notes from nest recorders.

Secondly we have used the registration years on pigeon rings found at known nesting sites to chronologically date site occupation. Racing pigeons are fitted with closed leg rings as chicks, and each ring is marked with the year of registration, details of the Union to which the pigeon is registered and an individual serial number. We searched for pigeon rings at known eyries outside the breeding season from the winter of 1997 to the winter of 1999 using a metal detector (Garret Treasure Ace 100). The most productive areas for racing pigeon rings were in and immediately below nesting eyries and below favoured perches. We also conducted searches at several crags where breeding had not been recorded but where non-breeding birds have been present in some recent years. Approximately 3,500 racing pigeon rings were collected from the 25 recorded breeding territories in the county.

Racing pigeon rings provide information on the year in which a pigeon was registered but not, of course, on the year in which it was killed by a Peregrine. Pigeon racing is divided into two seasons, the old-bird racing season which runs from April to early July and the young-bird season which runs from July through September. Young-birds are yearlings which are raced in the year that they are registered whilst old-birds can be of any age though they mainly comprise one to four year old birds (but principally first-year birds). Only a small proportion of pigeons which are raced are aged five-years or older (T. Ash, WHU,

pers. comm.). Thus, in the majority of cases it can be inferred that the racing pigeon was killed within five years of its registration date. Analysis of the age structure of racing pigeons taken by Peregrines throughout the year in South Wales has indicated that approximately 80% are yearling and one-year old birds *(personal data).* Assuming the pattern of predation on racing pigeons has remained similar over the years, most rings recovered will have been taken within two years of the date of registration.

We have used ring registration years to date the sequence of occupation of territories following the local extinction of the Peregrine as a breeding bird in the county during the pesticide era. This process involves a degree of subjective assessment as our recovery level of rings declines as time passes and older rings sink deeper into the soil or get washed away from the immediate cliff face. The position of the nest on a cliff can also influence the recovery rate, as some ledges are easily accessible or in situations where the rings are not readily washed away whereas other nests in the same territory can be inaccessible or in locations where the rings are quickly lost. The absolute number of pigeons killed by nesting Peregrines in a season will vary in relation to their availability and with the number of young the Peregrines rear. Nevertheless, a comparison of our ring registration dates with that of well documented sites indicate that it is still possible to date the year of first-breeding accurately to within two years (further details given in Dixon & Lawrence, MS). In plotting the chronological sequence of site occupation we have used ring registration dates in conjunction with documented breeding reports.

A survey of breeding Peregrines was carried out in 1999. Known previous breeding haunts were visited and additional potential nesting crags in the county were noted from 1:25,000 Ordnance Survey maps and subsequently checked for signs of occupation. Nevertheless, it is possible that some pairs nesting on minor crags were missed and pairs which failed early on in their breeding cycle were overlooked. The data presented in this paper only concerns nesting territories within the vice-county of Breconshire (vc. 42). The vice-county boundary differs from that of the administrative boundaries of 1974 and includes land within the Gwent and Glamorgan bird recording areas. To maintain consistency with previous surveys the number of breeding Peregrines recorded in former years have been adjusted to take into account the different county boundaries adopted.

RESULTS

Occupation of sites 1900-1950

In his county avifauna, Cambridge Philips (1899) stated that the Peregrine never bred in Breconshire and published records suggest that Peregrines first bred in the county in 1900 after a period of absence in the 19th century (Neale, 1902). It seems likely that at the turn of the century, Peregrines were only to be found nesting in the south of the county; between 1901-03 Walpole-Bond did not encounter the species breeding in the north during his extensive forays (Walpole-Bond Diaries), and the hills of Mynydd Eppynt have few suitable rockfaces. In his appraisal of Peregrine nesting sites in Britain since 1900, Ratcliffe (1980) stated that five of the eight tenanted crags in Breconshire in the 1920s-1930s were in the Brecon Beacons-Fforest Fawr massif, with an additional site in the Black Mountains. Derek Ratcliffe obtained much of his information on Breconshire's Peregrines from Col. H. Morrey Salmon who has stated that at least eight crags in the county held eyries from time to time and in the 1920's and 1930's six of them were tenanted regularly (Ingram & Morrey Salmon, 1957). The vice-county boundary includes an additional site which was assigned to Monmouthshire by Ratcliffe and Morrey-Salmon (D. Ratcliffe, *pers. comm.*). Thus, published records for the vice-county of Breconshire indicate that in the period 1920-39, there were seven regular nesting sites and two irregular sites. The two irregular nesting sites were in fact alternative sites for pairs normally nesting outside the county boundary in

Carmarthen and Ceredigion. There is some evidence of an increase in numbers during the early decades of the 20th century; in an area of central Wales, which included Breconshire, there were five or six pairs breeding in 1903 which had increased to 12 pairs by 1929 (Gilbert & Brook, 1931), and in 1941 Bruce Campbell recorded two pairs nesting only 1.3km apart on one escarpment in the Black Mountains (Ratcliffe, 1980).

We recovered racing pigeon rings dating from the pre-pesticide era at 15 different sites within the vice-county. Two of these sites were the irregularly occupied alternatives for pairs normally nesting outside the county and have been excluded from Table 1. Rings were recovered at all seven sites previously identified by Ratcliffe and Morrey-Salmon (sites 1 to 7; Table 1). Extracts from an unpublished diary revealed that two pairs occasionally nested in the Irfon valley whereas previously these widely separated crags were regarded as alternatives for a single pair (sites 7 and 8; Table 1). The number of rings recovered at a further two sites suggested breeding probably occurred in the years indicated but we could not find any documented evidence to prove this (sites 9 and 10). Furthermore, we identified an additional three sites, at which a small number of rings were found, where breeding possibly occurred (sites 11 to 13); Peregrines have bred at all these sites in recent years. Ring registration dates from the two probable breeding sites, one in the south (site 9) and one in the north of the county (site 10), suggested that breeding probably took place in the late 1920s to the late 1930s at one site and in the early 1930s at the other. The site in the south of the county was mentioned to Ratcliffe in the course of his historical researches but he was not given it as a definite breeding territory (D. Ratcliffe, *pers. comm.*). The site in the north of the county is 3.8km away from a known traditional haunt (site 7) and has been used as an alternative nesting site (Orton, 1989), though in recent years two separate pairs have been known to nest on the crags concerned.

Table 1. Site occupation at 13 Peregrine territories in Breconshire in five year periods from 1900-1959. Dark shaded cells represent territories with documentary evidence of site occupation, light shaded cells represent probable breeding indicated by ring recoveries and unshaded cells represent possible breeding at sites where a small number of rings were found. A pair which nested close to territory 4 in 1941 only has been excluded.

				12	12		12				
				11	10	10	9	13		11	12
				10	9	9	8	11	8	8	8
				7	7	7	7	7	7	7	7
		5	5	6	6	6	6	6	6	6	6
		6	4	5	5	5	5	5	5	5	5
	5	4	6	4	4	4	4	4	4	4	4
	4	3	3	3	3	3	3	3	3	3	3
	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1
1900-04	1905-09	1910-14	1915-19	1920-24	1925-29	1930-34	1935-39	1940-44	1945-49	1950-54	1955-59

Our racing pigeon ring recoveries, together with historical documentation, indicate an increase in breeding territories from one in 1900, to nine in the 1930s with a subsequent reduction to seven territories following the Second World War (Table 1). It is not possible to determine how many territories were occupied in any one year but from the number of rings found at the sites we suggest that there were seven regularly occupied sites in the 1920s and

1930s with an additional three irregularly occupied sites. A number of old rings which we found were so badly corroded that the dates could not be read, thus it is possible that the level of occupation in the early decades of this century is under-recorded. Furthermore, we only found five rings dating from the period 1914 to 1918 which is probably because at the outbreak of the First World War the Government banned the transit of all pigeons and ordered the owners to clip their wings as it was feared private lofts might be used for espionage; approximately 100,000 pigeons were spared to be used as messenger pigeons in war effort (Hansell, 1998). Many rings were found dating from 1939-45 (N = 157), reflecting the fact that pigeon racing did not cease completely during the Second World War. Furthermore, many racing pigeons were again donated to the military to be used as messengers, and a ring dated 1944 which was found at one site came from the American Pigeon Corps which established lofts in Britain at that time.

The pesticide era: 1950s and 1960s

By the mid 1950s published records indicate that only four, occasionally five, crags were regularly tenanted and one or two of these sites were robbed annually by egg collectors (Ingram & Morrey Salmon, 1957). The impact of pesticide poisoning in the mid 1950's was catastrophic and by 1963 the Welsh population reached a low of only six occupied eyries (Lovegrove *et al.*, 1994) and it was around this time that the Peregrine was lost as a breeding bird from Breconshire (Massey, 1975). Dating the onset of the population decline resulting from organochlorine pesticide poisoning is problematical and it probably started at different times in different regions of the country, though in most areas the effect was most noticeable from the mid 1950s (Ratcliffe, 1980). The last documented breeding attempt in Breconshire occurred in 1962 (D. Ratcliffe, *pers. comm.*), at the site where they were first recorded breeding in 1900. We found racing pigeon rings dating from the 1950s at eight Peregrine territories in Breconshire. The ring registration dates, used in conjunction with available documented evidence, provide some indication of when each territory was abandoned in the pesticide era (Figure 2). However, because rings from certain years were not found it does not necessarily follow that the sites were unoccupied, pairs and single birds were recorded at several sites throughout the 1960s (Griffiths, 1971). Nevertheless, the pattern of ring recoveries closely corresponds with the available documentary evidence from the time and indicates that the decline occurred from 1958 onwards.

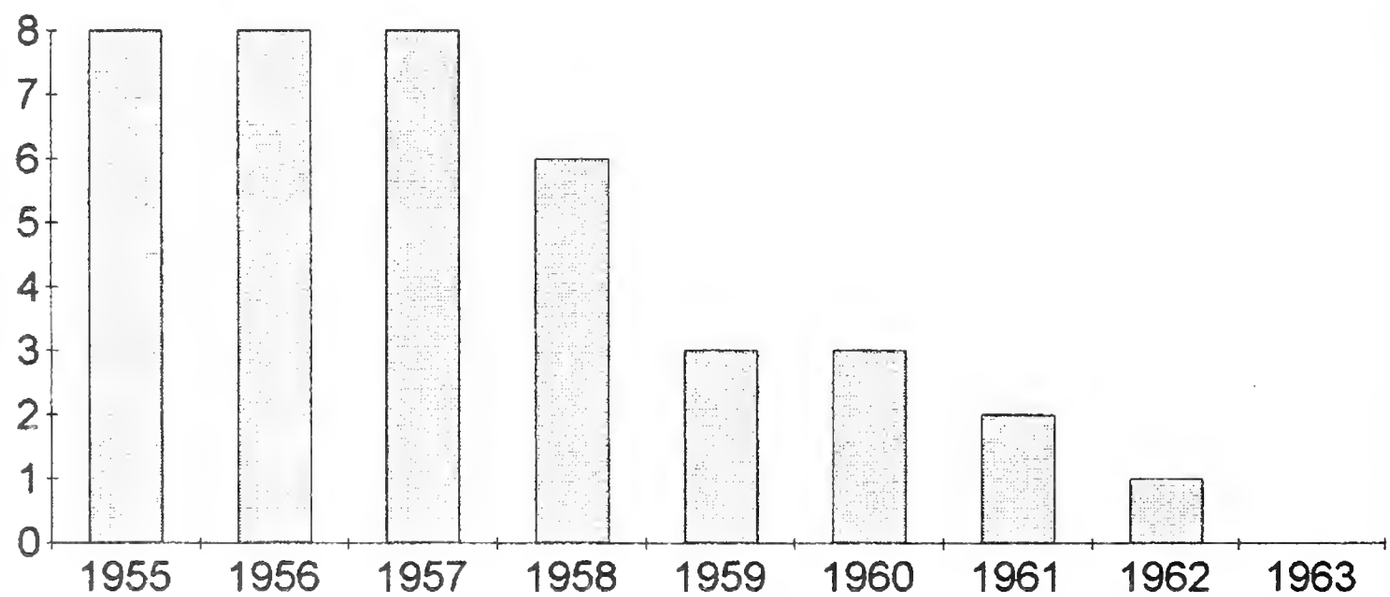

FIGURE 1: The cessation of breeding at Peregrine territories in Breconshire during the pesticide era. The years were determined from racing pigeon ring registration dates and available documented records.

The post-pesticide era: 1975 to 1999

The chronological sequence of territory re-establishment in Breconshire by breeding Peregrines is shown in Figure 2. Breeding first took place in 1976 with a second pair two years later at another site in the south of the county. From then on the number of breeding territories in the county increased and we have been able to identify 25 separate territories by 1999 (Figure 2). Territories can include several alternative nesting sites and a feature of the recovery period was that some traditional territories with widely dispersed alternative nesting crags became divided among two, sometimes three, separate pairs. Even so, many apparently suitable crags in the county still remain unoccupied. A notable feature of the recolonisation was that the traditional sites, where breeding occurred in the first half of this century, were the first sites to be reoccupied. New breeding territories with no previous history of occupation first became established in 1987. Our estimate of 25 Peregrine territories must be regarded as a minimum and it is likely that irregular nesting attempts at sites unknown to us have occurred over the recovery period. We are aware of five additional nest sites that have been used but these were probably alternative crags for pairs normally nesting outside the county boundary or else one-off nesting attempts.

The population growth of breeding pairs shows the typical pattern seen when population levels are limited by environmental factors (Krebs, 1972). Since 1992 the population appears to have fluctuated around a mean of 19.6 pairs, with a peak of 22 breeding pairs in 1996.

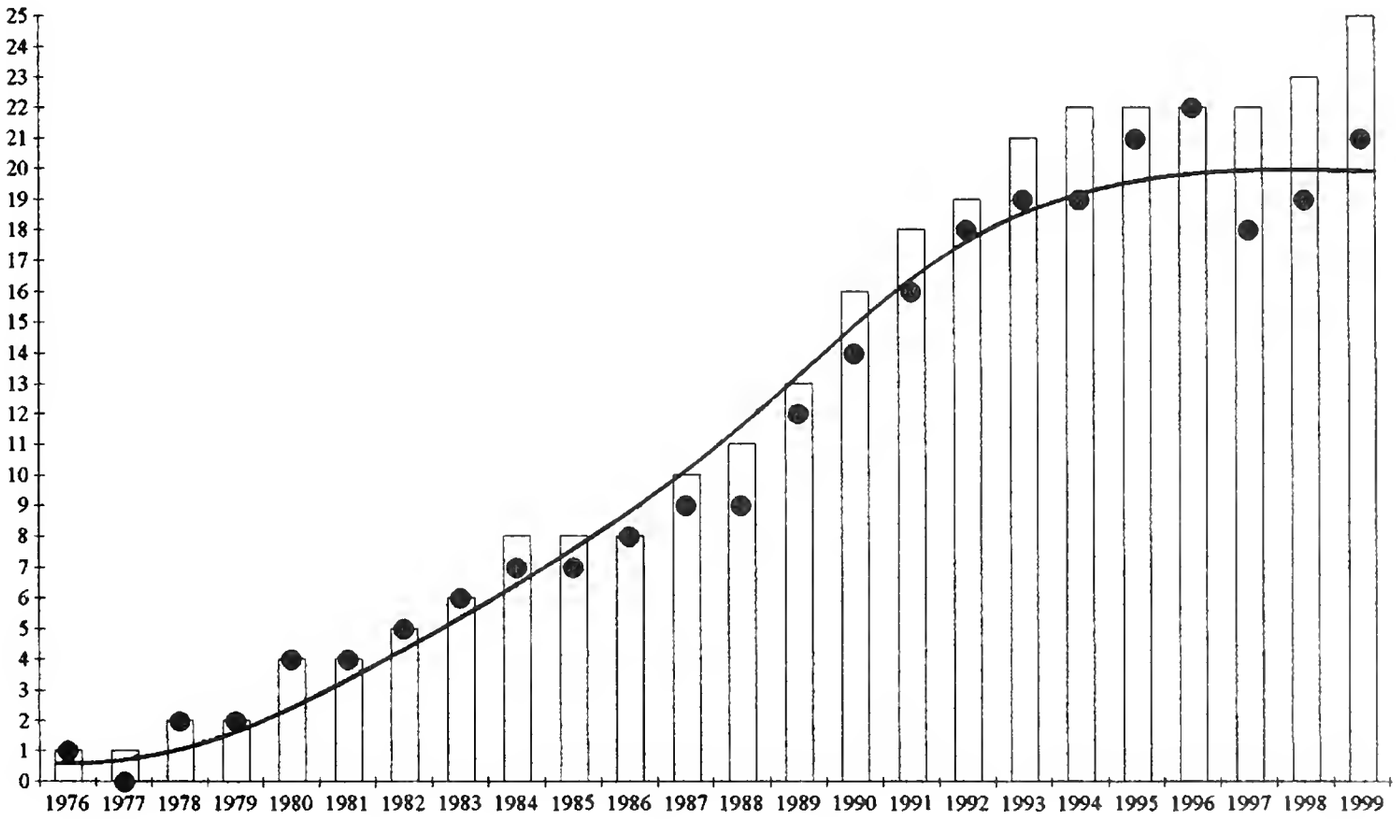

FIGURE 2: Chronological sequence of territory establishment in Breconshire from 1976 to 1999. Bars represent the number of different territories identified and the dots represent the estimated number of breeding pairs of Peregrines in each year. The data were derived from an analysis of racing pigeon ring registration dates and recorded site histories.

The total number of territories recorded in Figure 2 does not necessarily correspond with the number of breeding pairs in any one year as some territories are intermittently abandoned or else breeding does not always take place. To estimate the number of breeding pairs occupying territories in the county we have used the records made available to us by nest recorders and, in addition, for those territories which were not monitored, we have

attempted to gauge whether breeding took place from the number of pigeon rings recovered that were registered in a particular year. In the 12 territories where pairs failed to breed in any one year, three missed one season whilst others did not breed in up to four seasons. The proportion of territories where breeding did not take place in five-year periods for all sites monitored by nest recorders increased between 1980-99 (Table 2) in line with the population growth, an indicator that density dependent factors are regulating population levels (Newton, 1979). Data from documented site histories and ring recoveries combined indicate that the incidence of non-breeding is higher in the seven territories identified in the north of the county than those in the south. Between 1995-99 pairs failed to breed in 25% (8/32) of nesting opportunities in the north, but only failed to breed in 11% (9/82) of nesting opportunities in the south ($Chi^2 = 2.5$, 1 df, $P = 0.11$).

Table 2. The incidence of non-breeding in Peregrine territories in Breconshire by five year periods between 1980-99. The percentage represent the number of pairs which failed to breed in any one year in each five year period.

	1980-84	*1985-89*	*1990-94*	*1995-99*
No: territories monitored	7	12	20	25
No: and % in which did not breed	0	2(17%)	5(25%)	8(32%)

Since the peak in 1996, 4 territories appear to have been abandoned or breeding has not taken place in recent years. Two of these 4 sites are in the north of the county. However, over the same period 3 new sites have become established, 2 in the south and one in the north. At one site the abandonment has probably been because the nesting crag, amidst forestry, has become enveloped by tall spruce trees. Conversely, another site has become established at a forestry crag that has recently been 'opened up' by felling.

Breeding Distribution

Most of the breeding Peregrines in Breconshire are found nesting within the Brecon Beacons National Park, only 5 of the 21 pairs located in the 1999 survey were breeding in the north of the county. The low lying river valleys of the Usk and Dulas offer few nesting sites, nor were breeding Peregrines recorded in their tributaries draining the smooth hills of the Mynydd Eppynt catchment. Even within the Brecon Beacons National Park, where apparently suitable cliffs are not limiting, breeding pairs are not evenly distributed; 69% (11/16) of nesting sites were within 5km of the southern border of the county.

Breeding Ecology

All Peregrines found during our survey were nesting on rock faces. There are no confirmed records of Peregrines nesting on artificial structures, on the ground or in trees in Breconshire. Of the 25 breeding territories identified, nesting occurred on natural rock faces in 76% (N=19) of cases, though two had alternative sites in disused quarries (one of which has also nested in an active quarry). There were 5 territories where nest sites were in disused quarries, though at one of these sites the quarry has been reworked and the resident pair has remained. One pair has become established in a working quarry since 1994. Nesting sites in quarries tend to be more inaccessible requiring the use of ropes to reach the eyries on vertical faces, whereas those on natural rock faces are often lower, many of which can be reached without resorting to climbing equipment and some are merely 'walk-in' sites.

The eggs are normally laid in a scrape on broad vegetated ledges or in the unoccupied nests of Ravens. At quarry sites the use of smaller and bare nesting ledges is more commonplace and in such situations there is sometimes evidence of rudimentary nest building where the nest scrape is lined with small stones and shales from the immediate vicinity. Fine soils on bare ledges can be hazardous to nesting Peregrines as the scrape can

become waterlogged and in one year at a quarry site a clutch failed to hatch after the eggs become stuck in hardened mud after wet weather conditions. Clutches are normally laid in the first two weeks of April, though early eggs have been found in late March at some sites in the county and repeat clutches can be laid in May, or even in June as was the case at one territory in 1999.

Table 3. Clutch and brood sizes of Peregrines breeding in Breconshire from 1975-1999.

	Clutch/brood size			
	1	*2*	*3*	*4*
No: of clutches (N=27)	1	3	13	10
No: of broods (N=83)	18	37	14	12

For the period 1975-99 we have 163 records of nesting attempts where the breeding outcome was known, 72% (N=118) of which were successful in fledging at least one chick (including 3 repeat nesting attempts after egg failure). Of the 45 nests which failed, the stage of failure was known in 25 cases where 18 failed at the egg stage (though three laid successful replacement clutches) and 7 failed at the chick stage. Causes of nest failure could not be ascertained in most cases but many were probably directly caused by man; egg collectors and falconers are known to have taken eggs and chicks from nests in the county, and other nests and breeding adults have been deliberately destroyed. Natural causes of nest failure have included predation, wet weather and addled eggs. Where the clutch size was known, most pairs laid 3 or 4 eggs (mean clutch size - 3.2 eggs), and the mean brood size for successful pairs was 2.2 chicks.

In 1999 the breeding outcome was known for 20 of the 21 breeding pairs located in the county; 70.0% (N=14) were successful in raising at least one chick. The mean brood size for successful pairs was 2.3 fledged young (N=9). Chicks were probably stolen from 2 sites in the county and the eggs disappeared from another easily reached scrape. One clutch of 2 eggs failed to hatch, possibly as a result of disturbance in an active quarry, and another was predated when near to hatching by a Fox *Vulpes vulpes* or Badger *Meles meles.*

DISCUSSION

Our reassessment of the Peregrine population in Breconshire indicates that at a county level the trend did not mirror that of the national population, which was largely stable during the period 1900-1940 (Ratcliffe, 1993). Our analysis shows an increase from one territory to 9 over this period; a similar trend over the period 1900 to 1929 was noted in central Wales by Gilbert and Brook (1931). Previous estimates for the period 1930-39 suggest an average annual population of 7 pairs (numbers adjusted for vice-county boundary; Ratcliffe, 1980). Our study indicated that 10 different breeding sites were probably used at this time, though one was possibly an alternative nesting crag for an established territory in the north. No doubt Peregrines in Breconshire benefited from the increasing popularity of pigeon racing in the industrial valleys to the south over this period. The apparent decline from 5 to 4 territories (shown in Table 1) for the period 1915-19 coincides with the First World War when there are few documented records for the county. It is often stated that raptor numbers increased at this time because gamekeepers were called up for service. Many game-rearing estates in the county were decimated after the First World War and a reduction in persecution in the years following may well have aided the subsequent increase in the Peregrine population. However, the apparent decline during the war years may be real as racing pigeons were the principal prey of breeding Peregrines in the region then as they are now (Gilbert & Brook, 1931; Richards & Shrubb, 1999). The absence of the Peregrine's main quarry during the First World War would have undoubtedly had an impact, though

some pairs may have switched to wild bird prey and left no trace of their site occupation.

Of the 10 territories identified as being occupied in the inter-war years, seven appear to have been regular, well documented sites. The advent of the Second World War coincided with a reduction in the number of territories from 9 to 7, all of which appear to have been occupied fairly regularly. The decline during the years of the Second World War cannot be explained solely by direct persecution under the Destruction of Peregrine Falcons Order 1940 which didn't apply to Breconshire. Long established and well known sites would be the most likely to have suffered direct persecution, yet our study revealed that it was the 'newer' sites that were established in the 1920's and 1930's that dropped out during the war years. Such a pattern might be expected if the sequence of site occupancy and desertion was related to territory quality in terms of availability and diversity of prey. The likely shortage of racing pigeons during the Second World War perhaps explains why these newer territories dropped out. The failure of Peregrine numbers to quickly recover in the late 1940s could also be explained in terms of a diminished food supply. Times of austerity immediately following the war meant that pigeon racing wasn't as widely practised in the South Wales valleys in the late 1940s as it was between the wars (T. Ash, WHU, *pers. comm.*), and by the early 1950s egg-shell thinning as result of organochlorine pesticide poisoning was also beginning to show (Ratcliffe, 1993).

Ratcliffe (1993) reviewed the decline of the British Peregrine population in the pesticide era and established that it started around 1956 in southern England and proceeded in a wave northwards to reach Scotland by 1961, though the information for regions in-between was rather patchy. It appears that the main period of decline in Breconshire occurred very rapidly from 1958, similar to that reported for inland sites in North Wales (Ratcliffe, 1993). Interestingly, the last breeding site in the county was the same site where Peregrines were first recorded breeding in Breconshire at the turn of the century, a further indication perhaps of a relationship between territory quality and site occupation. Peregrines were reported in summer residence, but not breeding, at one or other of about 5 or 6 of the known breeding sites during the 1960s and early 1970s (Griffiths, 1971).

The recolonisation of Breconshire by breeding Peregrines was surprisingly late when compared with other regions of Britain, particularly when considering that the vanguard of the recovery was at inland sites (Ratcliffe, 1993). The first pair resumed breeding in the county in 1976 but it wasn't until two years later that a second pair bred, after which a steady and rapid increase ensued. The number of established territories surpassed the previous maximum of 9 in 1987, reaching an estimated peak of 22 breeding pairs in 1996. Surveys of breeding Peregrines were carried out in 1981, 1989 and 1991 with 4, 15 and 17 pairs found in the county respectively (numbers adjusted for vice-county boundary; Williams, 1992). These figures broadly mirror what we have found in our retrospective survey. Our study indicates that since 1992 the Peregrine population in the county has reached a ceiling fluctuating around 19-20 breeding pairs. There are a number of potential factors which could operate to limit breeding density in the area, namely (i) a shortage of suitable nest sites, (ii) a lack of surplus birds in the area, (iii) direct persecution and (iv) a limiting food supply.

There is unlikely to be a shortage of nest sites in the area as there are many unoccupied crags which are far enough away from established pairs to support new colonists. Most are fairly sizeable crags and appear eminently suitable, indeed many are currently occupied by Ravens which have similar nest site requirements to Peregrines. Furthermore, 4 occupied sites are within extensive ranges of cliffs which could potentially support two pairs. Thus, there are enough cliffs in the area to support more pairs of Peregrines. The population may have reached a stable ceiling because there are no potential recruits to enter the breeding population. However, this is unlikely as a number of additional crags support single birds or

even non-breeding pairs throughout the breeding season, and racing pigeon ring recoveries show that several of these sites have held non-breeders regularly since the mid 1980s (personal data). Intruding birds are frequently seen at Peregrine breeding sites and though these birds may be breeders from elsewhere it seems likely that at least some are non-breeding birds. Direct persecution was undoubtedly a major factor which limited breeding numbers in the early decades of this century and it continues to be an important factor in some areas of Britain today, notably on the northern grouse moors. In Breconshire there are no keepered upland estates and persecution of breeding pairs is relatively rare. Some clutches and broods have been stolen by egg thieves and falconers but persecution does not occur to the same extent in Breconshire as it does in the industrial valleys to the south. Breeding success in the county compares favourably with that found nationally (Ratcliffe, 1993).

It seems likely that the major factor limiting breeding density in Breconshire is the availability of food. In the winter the remains of migrant thrushes were found at nearly all eyries and obviously form a major part of the diet at that time of year (see also Richards & Shrubb, 1999). During the breeding season Peregrines mainly prey on the abundant supply of racing pigeons in the area. The switch to feeding primarily on racing pigeons comes with the advent of the pigeon racing season in April (Richards & Shrubb, 1999). Obviously Peregrines could move out of the area in winter if food supplies at that time became limiting, so it seems the most likely factor limiting breeding density is food supply in the breeding season i.e., the number of racing pigeons in the area. This would be exacerbated by a shortage of alternative prey species (Richards & Shrubb, 1999).

The South Wales valleys are one of the major centres for pigeon racing in Britain, the Welsh Homing Union alone issued over 101,000 rings to fanciers in south and central Wales in 1999 and the Royal Pigeon Racing Association issued around 18,500 more to fanciers in the same area. This food supply must be somewhat ephemeral due to the timing of races, which take place mainly on Saturdays, but stray birds and pigeons on training flights are also preyed upon *(personal data).* As Ratcliffe (1993) pointed out, the status of racing pigeons is especially significant for the Peregrine's future prospects, this is particularly true in inland Wales where alternative medium-size prey species are scarce. According to Terry Ash, the Secretary of the Welsh Homing Union, the number of pigeon fanciers in South Wales has declined in recent years. There are a number of reasons for this; there are fewer young recruits to replace older fanciers who die or retire, the cost of pursuing the hobby has increased, more stringent planning regulations have reduced the opportunity to establish lofts and others have left the sport citing high levels of predation by birds of prey as the main cause. The level of predation on racing pigeons has resulted in a renewed campaign to control predatory birds (e.g. Scottish Homing Union, 1998). However, at present the reduction in the number of lofts does not appear to be limiting the Peregrine population in the South Wales valleys as numbers continue to increase in Gwent and Glamorgan (J.M.S. Lewis and C. Richards, *pers. comm.*).

The higher incidence of non-breeding at territories in the north of the county may be a reflection of a less abundant food supply in the area (Newton, 1979). One factor which may influence the Peregrine population in the county, particularly in the north, is the decline of the Welsh North Road Federation. At one time this Federation was the largest in Britain and a great many pigeons were raced from the north to the South Wales valleys. In recent years many Welsh fanciers have changed routes to fly from the south, thus fewer pigeons could be expected to pass through the county. With fewer racing pigeons available we might intuitively expect a reduction in Peregrine numbers if food supply is a limiting factor. However, we could find no evidence for a reduction in the proportion of WHU registered rings found at nesting sites in the north of the county over the last three years *(personal*

data). The breeding distribution of Peregrines in the county provides further evidence that the availability of racing pigeons is an important limiting factor as the majority of pairs are found nesting close to the southern border adjacent to the Heads of the Valleys area; the valley towns of this region have numerous lofts.

Breeding success in the county is similar to that reported for Britain as a whole where 74% (621/843) of pairs reared young (Ratcliffe, 1993). The mean clutch size of 3.2 eggs is smaller but not significantly different for that reported in Britain as a whole (i.e., 3.4 eggs for the period 1980-1991), whilst the fledged brood size of 2.2 chicks is similar to that reported for the whole of Britain over the same period (Ratcliffe, 1993). Unfortunately we do not have sufficient data to compare breeding success within Breconshire or between years.

The Peregrine has been lauded as a sentinel species indicating environmental changes, particularly in the case of widescale pesticide contamination (e.g., Furness & Greenwood, 1993). To detect any incipient population changes it is important that information continues to be gathered on clutch sizes, hatching success and fledging success. The species inspires many Peregrine watchers to become very protective of 'their' birds and some are reluctant to visit nest sites. However, in order to determine if breeding success has declined in conjunction with the higher level of non-breeding which was detected in this study then it is vital that detailed monitoring work, such as that carried out by participants in the Wales Raptor Study Group, is continued.

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NOTE

COLLECTIVE GROUND FEEDING OF WELSH BUZZARDS

Towards the end of November 1999 I was informed by a local farmer, Mr. J. Davies of Pantgwyn, of large numbers of Buzzards feeding on the ground in 2 of his fields near Newcastle Emlyn. He had counted large numbers, 30-60 daily, feeding in 2 of his fields planted with winter barley. These fields were in a block of 4, all planted similarly in September and on a slope facing South East to East.

I visited the site on Nov. 30th and recorded 45 Buzzards *(Buteo buteo)* and 2 Red Kites *(Milvus milvus)* feeding on the ground in 2 of the fields (4 and 10 acres). The other 2 fields of approximately the same size and planted with winter wheat contained no raptors. I made 62 subsequent visits to the site between Nov. 30th 1999 and Mar. 14th 2000. Numbers fluctuated daily during December and January between a minimum of 19 and a maximum of 57 Buzzards. Numbers fell to single figures in late February, early March.

As might have been expected, weather conditions affected the number of feeding Buzzards. Numbers were lower on cold or wet days although they never dropped below 27 during December and only once below 20 in January (19 birds).

Timing of the visit was also critical. Mornings, up to midday produced the greatest numbers but birds moved in and out all day suggesting that they were local birds, both adults and juveniles. This is backed up by observations made on my journey to and from the site, a distance of approximately 8 miles. When numbers were high on the feeding fields few, if any, would be seen en-route and conversely when numbers were low on the feeding fields, many would be seen en-route.

The feeding method was usually of standing, watching and leaning, then running forward 3-4 yards and pecking at the ground. Sometimes it was possible to distinguish that the prey item was an earthworm but mainly the prey item was indistinguishable. Kites however, when present, rarely stood and watched but usually flew low (c 1m) over the ground then hovered before pouncing on its prey.

What perplexed me was that to the human eye all 4 fields were the same, similar size with a similar aged winter cereal crop but the raptors would only ever be found in the same 2 fields. From discussions with the farmer I learned that all 4 fields had lain fallow for several years but had been ploughed 3 years ago. Since then they had all been planted with oil-seed rape, which had been cut in July.

The farmer commented that he had examined the stalks of the oil-seed rape during ploughing in the previous year and found that they contained numerous slugs yet never was a Buzzard seen to catch or eat one.

There have been many papers written about the feeding habits of Buzzards some indicating a propensity for invertebrates especially earthworms. There have also been other records of large congregations of Buzzards in Wales, more recently 36 in a reseeded ley at Llanwennig in October 1994, 25 worming near Brecon in November 1998 and 55 feeding on slaughter-house slurry near Llanybydder in October 1995. None however mention such a prolonged congregation of so many individuals at one site.

Dr. D. James

WELSH BIRDS

'Welsh Birds' is the journal of the Welsh Ornithological Society and is published twice annually, in June and December. The December issue is primarily devoted to the Welsh Bird Report and the annual Report on Bird Monitoring in Wales. The annual Report on Bird Ringing in Wales now appears in the June issue.

Papers for Welsh Birds are welcomed by the Editor on any aspect of Welsh Ornithology. The Society is anxious that the journal should accurately reflect present ornithological activity in Wales. Thus we hope that all workers, professional or amateur, with results of bird studies in Wales, will always consider publishing information about these here. All papers will be reviewed by the Editor and an independent referee. Authors should follow the format of papers published in the journal and guidelines for authors have been drawn up and are available from the Editor (address inside front cover). Papers are accepted and published in either Welsh or English. Papers in Welsh should be supplied with captions to tables and figures in both Welsh and English and with an English summary. This follows standard international practice.

Short notes on interesting or unusual features of behaviour recorded in Wales are also welcome. An accumulation of such items is of considerable value. Notes should be short and succinct, ideally of not more than half a page in length. Notes may also be submitted in either Welsh or English.

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